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THE AMERICAN SOCIETY OF ORTHODONTISTS

Serial
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SIXTH ANNUAL MEETING HELD AT
NEW YORK, N. Y., DECEMBER 27th,
28th, 29th, NINETEEN HUNDRED SIX

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Dates and Places of Meetings
of
The American Society of Orthodontists

First annual meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second annual meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third annual meeting held at Buffalo, N. Y., December 31, 1903, January 1 and 2, 1904.

Fourth annual meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth annual meeting held at Chicago, Ill., September 29, 30, and October 1, 1905.

Sixth annual meeting held at New York City, December 27, 28 and 29, 1906.

Table of Contents

President's Address
Rodrigues Ottolengui, M.D.S. 3

Some Considerations in Retention
Herbert A. Pullen, D.M.D. 21

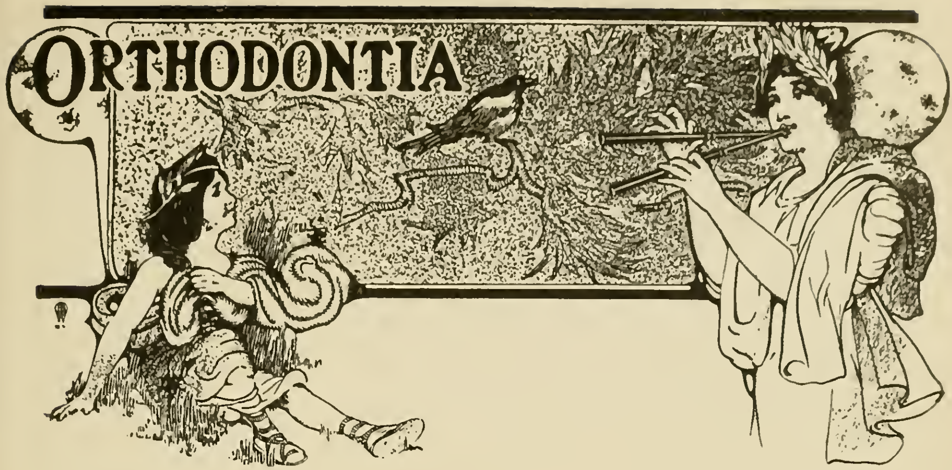
Prophylaxis as Related to Orthodontia
Dr. H. C. Ferris 52

Use and Application of Inter-maxillary Force
Dr. Norman D. Reoch 61

An Appliance for Expanding the Dental Arches, Thereby Increasing the Size of the Nasal Passages and Superjacent Bones
Dr. E. A. Bogue 82

A Case of Double Resection of the Mandible
W. O. Talbot, D.D.S. 94

The Rotation of Molars
J. Lowe Young, D.D.S. 96



President's Address.

By Rodrigues Ottolengui, M.D.S., New York.

Fellow Members of the American Society of Orthodontists:

At the outset let me thank you for the honor conferred upon me by all of you in choosing me as your President for the last year. With me this is no empty phrase, no perfunctory words, but the simple statement of a fact. I have felt greatly honored to be President of this Society, and I do thank you. For what is the American Society of Orthodontists?

Orthodontia is becoming, *has* become, a science; a science so entwined with art, that the orthodontist performs the dual function of healing and beautifying the most attractive, the most important part of the human body. Could there be a higher calling?

The Prospect of Orthodontia as a Separate Specialty.

Within the last decade a movement has been inaugurated looking toward the separation of orthodontia from the general practice of dentistry. This society was organized to assist this project. Orthodontia is to-day already recognized as a separate specialty. The better class of dentists are abandoning the desultory attempts at tooth regulation of the past, and are cheerfully turning over that part of their practices into the care of the orthodontia specialists. And this present status is very largely due to the influence and to the teaching of the members of this society. Therefore again I say, it has been an honor to occupy for a year the post of chief executive in such an organization, and once more I thank you.

It would be well for us at this time to calmly view the prospect, and gazing along the path of the future to measure the heights which bar the way and the abysses which must be spanned. The future of orthodontia! I doubt if even those present comprehend the vast scope of the work which lies ahead. I know that the general practitioner does not. May I attempt to place before your eyes just a kaleidoscopic view of the horizon as I see it? Let your minds travel back to the landing of the Pilgrim Fathers upon Plymouth Rock! Crossing at last that devoted band felt safe, and fell upon their knees in thankfulness to God. Yet were they safe? They were on dry land at last, yes! But what knew they of the vast continent to the west of them; of the savage hordes in their very vicinity?

I liken you of this society to that little group of men. You have this society, and you are recognized as specialists in orthodontia. In the one you have landed upon the Plymouth Rock of your faith, and in the other you have reached the dry land of your ambition. Do you recognize the immensity of the work yet ahead for this society? Half a century from now, the dental historian will publish the roster of this society and call you the pioneers in the new movement. Pioneers are leaders. Do you know the roads?

In the main the so-called regulation in the past has meant the straightening or aligning of teeth. I state dogmatically that the chief purpose was to correct that which was unpleasant to look upon. To leap the chasm from the distant past to the pregnant present, the real work of the orthodontist to-day is to render as nearly perfect and useful as possible the mechanism of mastication. The mouth is the portal of health, as it too often is the inlet for disease. Food is absolutely required to sustain life, and the more thoroughly masticated it is, the more perfectly will it be assimilated with the least strain upon the other organs involved in the process. That man who has given little thought to this will say perhaps: "What rot; people can chew just as well with crooked teeth as with straight. Don't they always occlude; never mind how crooked they are."

It is this sort of crass ignorance, my friends, that you must go out into the wilderness and preach against. In the first place crooked teeth never occlude, and any set of teeth in malocclusion will perform its function imperfectly in exact proportion to the extent of that malocclusion.

But let us grant for an instant the wrong hypothesis above stated, that people may be able to chew with crooked teeth. The answer is, "Not only would the same person chew better with teeth in true occlusal relation, but he will be able to chew with them longer, for every malposition is a menace to the tooth in exact proportion to the departure from normal.

Orthodontia and Prophylaxis.

Neither dentist nor orthodontist sees many absolutely perfect teeth, because the happy possessor of a perfect set of teeth would have no need of either. His sound teeth would constantly contribute to the soundness of his bodily health, and his sound body, with all organs properly nourished, would in turn offer no menacing regurgitations to his teeth. Thus the most important phase of prophylaxis to-day, not only dental but of general prophylaxis, is the close scrutinizing of dental arches, and reference to an orthodontist that all malocclusions, however slight, may be promply corrected. Orthodontia is the great preventive measure of the future. It is the prime promise of the abolition of disease. The subject of heredity is too vast a one to be touched upon seriously in this address, but Dr. Rhein, I think it was, who at the last meeting of the Stomatological Section of the American Medical Association prophesied that Orthodontia would in time delimit itself. That as soon as two generations of human beings have perfectly occluding teeth, their progeny will no longer pay us large fees for straighening teeth.

Occlusion in Relation to Physiognomy.

I am fully aware that the art side of our work is important. But I contend that it is nevertheless secondary, and for this reason: There is no definite basis of art; no final measure of beauty; no authorized arbiter as to which is the handsomest countenance. Therefore, one man may alter a set of crooked teeth, and so change the face of the individual as to produce a result entirely in accord with his own estimate of art; a face even pleasing to many. Yet the teeth may not have been arranged so as to occlude.

But we do have a final standard of occlusion, and whenever we can rearrange crooked teeth so that they can be measured by that standard, then we achieve the highest function as a masticating apparatus, place the teeth where they will occupy the safest locations against the ravages of disease, and within five years that face will have assumed a configuration which every one will call an improvement on the original, regardless of what his standards of art and beauty may be. In briefer language, we may beautify a face without doing the best for the occlusion, but if we obtain the best possible occlusion of a given set of teeth, we always attain the most beautiful form of face possible in that individual.

What then is the closest duty pressing upon us as members of this society? It is this. We must cultivate such relations with general practitioners both of dentistry and medicine that we may be enabled to convince them of two important facts. First, that the orthodontist and not the dentist should do the work. Second, that the dentist, not the orthodontist, should find the work.

Dentists should be made to see that the slightest malocclusion is a menace to the future of the dental organs. He should therefore be on the constant watch for malocclusion, and ever ready to advise orthodontic interference as the most important of all prophylactic measures.

A Question of Ethics.

It follows therefore that our relations with dentists, rhinologists and others should be very close, and if close should they not be thoroughly ethical? This brings me to the blot upon our escutcheon.

I have said that the members of this society in the future will be called Pioneers. Would you have those same historians record the fact that we were false leaders, that we were not true professional men, but that we were tainted with commercialism?

When the young dentist fresh from his Alma Mater begins his professional battle, how does he start? How does he build up a practice? Suppose you knew such a young man, and you discovered that he had visited the butcher, the baker, the stationer, the cigar store man, the barber, all the trades people in his neighborhood, and had made the offer of a commission on the bills of all patients sent to him? Would you think that young man was starting out right? If wrong for the young dentist, why should it be right for the orthodontist?

The Question of Commissions.

This question of commissions is to my mind a very serious one, and without bias of any sort it should be calmly discussed, viewed from every aspect, and then definitely settled for all of our members. There are, of course, many excuses to be made for those who have given commissions, though less for those that have accepted them. In the first place, it is done in connection with other specialties. It has been condemned by the more honorable of medical men, but it has never been stamped out, and is still carried on to a great extent. Indeed, to a much greater extent than can be known because the arrangement is generally secret, which fact alone condemns it almost without further argument. No medical man makes a secret of the fees which he receives direct from his own patients for his own work; why, then, make a secret of the commissions obtained through reference of patients to other men? There is only one answer. No, there are two. Some are ashamed of it. Others, who know not shame, realize their patients would never return did they know of these secret fees.

Orthodontia specialists are both few in number and new in the field. Many have given up general and perhaps lucrative practice to take up this specialty. Moving into one of the larger cities such a man feels himself a stranger and in a difficult position. Without the countenance and even assistance of the dentists he must make slow progress in building up a paying practice. He consults with the dentists of the place, and many advise him to offer commissions; some even promise him patronage on those terms. Many of the practitioners who have done this are men of standing, men of national reputations. Thus has it been reasonable for our members to adopt this tempting advice coming from such sources and affording apparently the shortest road to success. Nevertheless, I think it has been a grave mistake, and such a mistake as will hamper the life work of every man that follows the course.

Let me put this proposition to you from two aspects, that of the receiver, and that of the giver. First, then, as to the recipient of the commission. Should any honest man accept a dollar which he does not earn? Certainly not. How, then, is this commission earned? What does the general practitioner tell himself that he does for that patient, or for that orthodontist in exchange for that fee, for we have agreed that he must earn it to be entitled to it. The service which he does for the orthodontist is that he provides him with a patient, furnishes him with work. This can not be disputed, and in any similar transaction between trades people, as when a man sends another a customer for a house, the commission is a perfectly honest payment for services rendered. But certainly it is not professional. Wherein lies the difference, you ask? I will tell you. In all business relations the business man acts on his own responsibility; he must safeguard his own interests. The purchaser of a house thoroughly comprehends this at every stage of the transaction. He intends to get that house for as little money as possible. He knows at the same time that the seller will get every dollar he can. The game is open. The agent or intermediary, therefore, who arranges terms on which the buyer will buy, and the seller sell, injures nobody, and inasmuch as he has contributed to the deal he is entitled to the preagreed commission. With a patient it is entirely different. He places himself, his life, his body, or that of his wife or child, into your keeping. He knows nothing of the conditions. He has faith in you, and acts by and on your advice. If you recommend him to an oculist he goes. If to a rhinologist he goes. If to a specialist of any kind he goes. Has the practitioner a moral right to trade upon that trustfulness, to take a commission, and without the knowledge of that trusting patient?

But the commission taker tells you that he serves the patient because he selects a competent man to do the work. That sounds good, for just about a minute. Does he select that specialist because he knows that he is the best? Or that at all events he is good enough? Or does he send the patient thither because he gets a commission from that man? If he knew another orthodontist, just as capable, living ten miles nearer to that patient's house, but who did not give commissions, would he send the patient there, or to the man that gives commissions? I am sure that some would say, "I would certainly consult the patient's convenience, if the other fellow was just as good." To such I answer, "Sir, you deceive yourself. You would never think him as good, if he paid no commissions." No, my friends, while a hundred excuses have been offered for accepting commissions, I have never heard one that I could not utterly destroy with a logical and convincing response. In the final analysis there is but one reason for accepting a commission, and that is to get money without working for it.

Let us turn now to the question of giving commissions. I frankly admit the usefulness of a commission as a practice builder, for a while. But observe that I qualify that usefulness. After a while the commission scheme will hamper instead of advance progress. Thus there are two sides to this aspect of the question: the utility of commissions, and the moral right to give them.

I am convinced, mainly from the experiences of others, that the giving of commissions will lead any man into a most adherent quagmire of difficulties. The ramifications indeed are too great to follow. There is one important tangle, however, worth mentioning. I am satisfied by my own experience that the future of the orthodontist, as with the dentist, must depend upon the impression he makes with his own personality, with his own work, upon the people with whom he comes into contact. It is not my custom to mention my own affairs, but I can not refrain from accentuating this fact by so doing here. I have this winter received the majority of my new patients through other patients; three from physicians unknown to me, but who have cared for patients of mine and so have seen my work, and only one patient has been referred by a dentist. True, I do not give commissions. But even this one case referred by a dentist leads us back to the troubles of the commission tangle. The child had been taken to her regular attendant, who advised that she is too young, and she is rather young, so that man must not be condemned. But the parents were not willing to wait, and asked the advice of another dentist, who was an acquaintance. This man advised consulting me. The parents then returned to their regular dentist, and he acquiesced in the consultation. In quite similar instances known to me both dentists have claimed commissions. Dentists who accept commissions likewise have often demanded commissions for patients recommended by patients first recommended by them. Thus the orthodontist who once starts giving commissions lays a trap for himself into which he must inevitably fall. He ties a chain and ball around his feet which will prevent him from building up his practice along the truest lines, by the recommendation of pleased patients. From the statistics of my own practice above cited, I am sure that this community at least is awakening to the necessities of correcting malocclusions, and that from this time on there will be a rapidly increasing demand in this and other large cities for competent orthodontists. Good practices can be built up without paying commissions to dentists or rhinologists. On the other hand a good business can not be built up in any other manner.

As to the moral side of it, I am sure I am on safe ground in condemning the practice. Every man is entitled to as large a fee as his patient can afford to pay; and conversely every true orthodontist must stand ready to accept many cases for small remuneration, where the patient's means are limited. Therefore, we can not do justice to ourselves nor to our patients if we must ever have the idea of a commission in our minds. Men say that they can pay commissions without charging the extra amount to the patient, but in this they are self-deceived. It can not but be a factor in fixing the fee for the wealthy parent, nor can it but hinder us in accepting the child of the poor man. Therefore I argue that the commission method is both unprofessional and immoral.

I feel that I would be derelict in bringing up this topic for discussion without offering a remedy. Like all cancers it must be cut out, and the sooner the better. And I think that it is the paramount duty of this, the first associated body of orthodontists in the world, to heroically apply the knife and set the standard which all others will feel compelled to follow. Some of our members I have no doubt are fulfilling agreements to pay commissions. Such men, of course, are bound to keep their contracts in regard to patients already received, but I recommend action by this society which shall prohibit any of our members from ever again receiving a patient upon a commission basis, and I advise the adoption of the following standing resolution:

Resolved, That in the opinion of the members of the American Society of Orthodontists, the practice of paying a commission, honorarium, or any sort of fee in consideration for the reference of a patient is both unwarrantable and unprofessional; and be it

Resolved, That the payment of any such commission, honorarium or fee, by any member of this society shall be sufficient cause for the expulsion of said member, by vote of the society after conviction: and further be it

Resolved, That in case of co-operation in the care of a patient between a general practitioner and an orthodontist, there shall be no division of fees, but each man shall render a separate bill for his personal services.

It is my view that the spirit of the above should be regularly engrafted within our constitution, either as a part thereof or in connection with a code of ethics which might be adopted, though personally I am opposed to codified ethics, unethical men rarely becoming ethical because of printed rules. For the present, and at this meeting, I think it would be wise to adopt this as a standing resolution.

I believe that a committee should be appointed to so revise our constitution that some of the ambiguous sections therein may be made more explicit. I say this because all the officers during the past year have been hampered in their work because of different interpretations of some of the language of our constitution.

In conclusion I wish once more to thank you for the honor of having filled the post of president for a year. I believe medicine, the art that heals, to be the highest and noblest calling to which man may devote his life. And of all the branches of the healing art, what more attractive, more beautiful, more honorable than to take into our care the children of men, and by our labors to make them perfect and beautiful men and women?

Discussion of President's Address.

Dr. Chas. F. Ash, Brooklyn.

I do not believe that the average general practitioner wants to assume the responsibility of doing the orthodontia work for his patient. Personally I have done almost none of it. I have allowed a great many cases to go undone because I did not feel sufficiently competent to attempt the work myself, and there was not a man practicing the specialty of orthodontia near enough at hand to make it possible to refer the patients to him.

Passing on to the question of commissions, your President has in a measure stolen my fire. I have known from time to time of the questions which have been in the minds of practicing dentists and orthodontists about commissions, and as I said before, every question has two sides, but I believe there is very little which can be said in favor of the payment of commissions by professional men; I do not believe it admits of much discussion. I believe the man who is an honest general practitioner of dentistry is not as capable of taking care of the regulation of his patient's teeth as the man who makes it a specialty. So therefore, if he be honest, and wishes to give his patient the very best service, he will recommend him to the man who makes orthodontia his special work. And further, if he is honest, he can not expect a commission.

Two Claims for One Commission.

I have known of a case in a comparatively short time where the dentist said to the parent, "The little girl's teeth should be regulated." The response was, "Well, Doctor, don't you think you should better go ahead and do it?" The dentist said, "I am not a specialist, and consequently not so well fitted to do it. I would recommend Dr. Jones." A very short time afterward, the father, with the little girl, while walking in the park, met a dentist who is a friend of the family. He picked up the little one and said, "Let me look at you." He said to the father, "This child's teeth ought to be regulated." The father replied, "Yes, I understand that is so." The dentist said, "Take her to Dr. Jones: I will give you a letter of recommendation, etc." Dr. Jones, when called upon, looked over the mouth, saying: "Yes, the child needs the services. It should be undertaken at once." So they proceeded to make an arrangement to have the work attended to. The orthodontist discovered a cavity needing attention. He said, "Here, take the child over to Dr. Smith and have this filling done and send her back to me." "But Dr. Smith is not our regular dentist, only a friend of the family," was the reply. "Dr. Brown is our regular dentist." So over they go to Dr. Brown to have the tooth attended to, and come back. After the orthodontia work is finished, Dr. Jones sends his commission to Dr. Smith, because he believes Dr. Smith recommended the patient. Dr. Brown interviews Dr. Jones, and compliments him on the work he did in that case. Nothing further is said. One day, he said: "By the way, has Mr. X— paid his bill yet?" "Why yes," replies Dr. Jones. "Well, I thought perhaps I might have received a check by this time." "Why, I sent that check to Dr. Smith." Dr. Brown says: "Well, I recommended the patient in the first instance, etc." The result was a grand mixup in the matter of commission. I think finally one-half of the commission was allowed each one of the dentists.

As I have already said, I do not think the question admits of much discussion. I do not think that a man who is honest with his patient can afford for his own sake, or the sake of his patient, or the sake of his conscience, to be dishonest in the matter of commissions.

Dr. F. S. McKay, St. Louis.

I feel it is somewhat of an unfair advantage to take of one who has as much on his mind as your secretary, to ask him to discuss so important a matter as the President's address. I must confess to a feeling of disqualification.

I was pleased to hear Dr. Ottolengui speak of this society as a body of pioneers, as I believe that represents, in the truest sense, our position. We are pioneers, and when the history of orthodontia is written, there will be no question but that we will be given that credit freely, and be recognized as the pioneers in the true orthodontia. Pioneers of various sorts are historically in high esteem, and I ask, could there be anything more honorable than being known as pioneers in such a field as orthodontia? That is, as being the first men to really apply basic principles to such a work as this, for the betterment of humanity. It seems to me an idealistic position in which we find ourselves. How the real object of orthodontia has changed since first concieved! It used to be considered a matter of looks entirely, or nearly so; now we go beyond; we allow the looks to take care of themselves; if we create or restore normal occlusion, the looks are safe. The real object is to restore, or make possible, perfect function.

Fletcherism.

I can not help thinking of what a close connection there is between this viewpoint and the writings and teachings of a man named Horace Fletcher. He is a layman, a citizen of the world; a man of wealth, who has devoted his energy and fortune to one grand object, namely mastication. His works show a deep and broad study of the processes of mastication, and the physiology of digestion. He carries to excess, you may say, the function of mastication. He would have people chew, and chew, and chew their food, reducing every mouthful to a liquid before swallowing. He would even have you chew liquids, so to speak; he insalivates a mouthful of coffee, tea, wine, or anything else that has taste. He extracts every particle of taste there is in a food substance. His claim is that buccal digestion is thereby made perfect, and every particle of food is prepared for the stomach. Furthermore, one who practises what is known as "Fletcherizing" their food, he claims, would need and consume a much smaller quantity of food than by the ordinary method of eating. If you will watch in any restaurant, you will see that the average person masticates with too little thoroughness. I have experimented in this way, for instance: while eating at a table with a party of people, who were served with the same kind of food, I have noted how many "chews" a certain individual requires to prepare the mouthful of food for swallowing. In one instance of a young lady, frail and enemic, the average was eleven to fifteen for a mouthful of the same character of food that required me one hundred and ten to one hundred and thirty. It impressed me greatly with the average neglect in this function.

I am not a crank on Fletcherism, but if that proposition is correct, and I believe it is, is there not a definite relation between the ability to masticate and the occlusion of the teeth, the apparatus we have to masticate with? If we are going to masticate properly we must have as good a masticatory apparatus as we possibly can have, and that is the work of the orthodontist pre-eminently, I believe.

It may seem queer to speak of orthodontia as a prophylactic measure, and yet I believe with our President, it is one of the greatest—if not the greatest—of prophylactic measures. The proper contact point, mesio-distally, and those other conditions which go to make up a finely finished case in orthodontia, establish the best prophylactic conditions in the mouth.

Art in Orthodontia.

The Doctor said there are no definite rules for art; therefore the face alone is not a good point for diagnosis from which to treat malocclusion, and I think that is perfectly true. On the other hand, occlusion is a definite thing, and it therefore must be a proper basis for diagnosis and treatment. I wonder, on the other hand, if Dr. Ottolengui realizes how much our ideas have changed in the past few years with reference to art in relation to orthodontia? Types are now considered above everything else, and not any set standards. As Mr. Wuerpel, of St. Louis, has said recently, there is no standard of beauty. It depends upon who is looking at a thing as to its beauty. I therefore feel that in any given type, when we have placed the teeth in normal occlusion we have done the best for that individual, as an individual, that we can possibly do in our own sphere of action.

Commissions.

As to this matter of commissions, I am glad it has been brought up. I feel that the time has come when definite action one way or the other is called for. It is hard for any one of us in this community working alone to establish a new order of things. We are simply units here, there, everywhere, all over the world. But when action is taken as a body, each man in his own community feels that he has the moral support of all to back him in his position. The best way to make changes is by concerted action.

In the main I agree with the essayist, and yet I feel that there are arguments which are familiar to most of those present, which would render this practice not altogether unwarranted. I believe, however, that the standing of orthodontia would be raised and bettered by the abolishment of commission giving in any form of division of fees.

Dr. Milton Watson, Detroit.

I desire to express my profound appreciation to Dr. Ottolengui for the courteous and judicious manner in which he has handled a delicate subject, my only regret being that the matter did not receive similar attention years ago, before the evil became so thoroughly rooted.

I began my practice by giving a commission, as did nearly all the members of this Society, and I continued it long enough to see the many evils associated with it. To enumerate them would simply be to repeat many of the points so clearly brought out in the address. I could, however, relate some additional experiences, showing its tendency to make men deceitful, and deception has no place in the professional man's career. One with any sense of honor must at times have been keenly embarrassed, who has ever been a party to any "commission arrangement," regardless of whether he has given it or received it.

The impropriety of being connected with a plan of such a character finally become clear to me, and I determined to discontinue it, and made an announcement to that effect to every dentist from whom I had ever received patients. It is only fair to say at this point that there were a number of men who never accepted any commission, and still others who soon saw the evil of such an arrangement, and asked that it be discontinued. I believe arrangements whereby one either offers or receives "inducements" of any character for the reference of patients is positively and unqualifiedly wrong, and I hope every man in this Society will hold up both hands for the adoption and rigid enforcement of the resolutions offered by our President.

Dr. Ash. When I was speaking before, I said Dr. Ottolengui had stolen my thunder; I meant this. I have given this matter of commissions some thought, and to this extent: I had no knowledge that Dr. Ottolengui was to introduce this resolution, but had already arranged in my mind a resolution which I intended presenting before the meeting of the Second District Dental Society, along the same line, against receiving commissions. I believe with the President, that the only way to get rid of this commission business, is to absolutely "cut it out," and the only way to do that is to cut it out from both sides. If the American Society of Orthodontists will put their members in a position where they can say to men sending them cases, that they are compelled to refuse paying commissions, under penalty of losing their standing or membership in their Society, it will be a step made in the right direction. Then, too, I think the dentists should be in the same position, and I propose that such a resolution shall be presented at our next meeting, which I hope you gentlemen will attend. The resolution will come up for action at the following meeting. I want the moral support of your presence when the resolution is read.

Dr. Casto, Cleveland. I am heartily in favor of the resolution as presented by Dr. Ottolengui, and am thoroughly in accord with the movement. As regards experiences, I have not had a great many. I have paid some commissions. It was my intention to treat all the dentists alike, but I found, as I had been informed, that a great many of the men would not accept commissions in the community where I was located. I gave commissions because I had been led into it by the older men in the specialty. I understood at the beginning of my career that it was a custom followed by most of the men. I understood it was legitimate and fair, and I felt it was at that time, but as I see it now, and I have felt for several months, it is something which should be terminated, and I believe this is the time to terminate it. As Dr. McKay has said, we feel we need the moral support of the Society of Orthodontists behind us.

Dr. C. A. Hawley, Columbus.

In regard to this address, I think we are all very proud of the courage Dr. Ottolengui has shown in bringing the matter of commissions up as he has done. I think we are fortunate also in that he is able to view the question from both sides, from that of the general practitioner as well as from the standpoint of the specialist.

It seems to me that one of the main points in this matter is the question as to the service that is rendered. It is the duty of any man to his patient to refer him where he can get the best services, in case it is something he does not wish to do himself, and that is a service which can not be paid for. I would feel most degraded to accept from one of my patients a fee for referring him to some other man for work I do not wish to do myself, and I have had occasion to send many patients for special services. That is a service which I owe that patient: it is a question of honor between myself and the patient, and no fee can compensate for it.

In talking this matter of fees over with a prominent surgeon, and as you all know it is a matter which comes up there also, as I am told some surgeons pay commissions, he took this stand: He says you have no right to accept any fee from a patient without telling that patient what the fee pays for. If you are willing to discuss the matter with the patient, then you are honest, and if the patient chooses to give you the fee with that understanding, it is all right. For instance he says, "I often give part of my fee to a physician, but I never do that without explaining the matter to the patient. I say to them: 'So much of the amount it will cost you is for me for the operation, and so much of it is for the physician who takes care of you afterward.' That commission pays for something: for the care of the patient." In the same way I can see where an orthodontist might be justified in giving a commission, or rather, dividing the fee, but not for referring the patient.

I am glad to have the opportunity of indorsing this resolution. I hope it will be carried, and certainly think it is the opportune time for it to be adopted by this Society.

Dr. Varney E. Barnes, Cleveland.

Dr. Ottolengui has brought up points which are vital to the specialty of orthodontia. Look at this matter of commissions! We have limited ourselves to the practice of orthodontia, and have cut off all the rest of dentistry.

If we are to adopt this resolution we must make it binding on ourselves, and the men outside this society as well. If the resolution goes through, a copy of it should be sent to every dental magazine and published.

I believe when the resolution is taken up, it should clearly differentiate between a commission and the division of a fee. The division of a fee must be known to the patient, and the man who gets a part of the fee —say the dentist—must do some actual work in the case; he must take charge of and assume a part of the responsibility.

Dr. Alfred P. Rogers, Boston.

I feel that this Society, with such noble aims and principles, will have washed the only stain from its garments when it has adopted this resolution. I feel greatly encouraged, because not long ago when I started as a specialist in this work, I determined to enter the field as cleanly as possible, and I offered no commissions, nor will I do it. I stand or fall on that principle. Possibly a practice might be secured sooner by following the other plan, but not better.

I want to thank Dr. Ottolengui personally for bringing this matter up. It is an opportune time. The society is in a position to accept this resolution; in doing so it is going to put us on such a high plane of professionalism that no man can raise a finger against us. We will do clean work founded on noble principles.

Dr. J. Bond Littig, New York.

I was surprised to hear the President make this reference to commissions. It has all been a surprise to me. I did not know commissions were ever given!

I have gone so far in my own practice as to refuse to take any money in advance from the patient. If he paid a part of the fee I was obliged to carry the work ahead under any circumstances. On the other hand, where no payment had been made in advance, if the patient did not do as I told him, and put himself completely under my charge, I could dismiss the case.

I did not know a commission was ever offered except by hotel men. A hotel man came to my office with a Cuban; he said he wanted me to correct the boy's mouth in a certain length of time. The patient had to go back home in a short time. The hotel man wanted a commission for bringing him to me. I said, "I can not do the work in the time specified, and as to the commission, you will have to go somewhere else." The thing you discharge your cook for when he goes to the grocer, I am surprised to find being discussed here.

If a man sends a patient to me to secure my services in the regulation of his teeth, or any other services of which I might make a specialty, and expects me to hand him a commission, I would not take the case under any circumstances.

Dr. Lloyd S. Lourie, Chicago. I would like to say a good deal on the subject of commissions, but am afraid I am not a clear enough thinker to extemporaneously clothe my thoughts as I would wish to present them. I want to express my appreciation of Dr. Ottolengui's address, and for his fine wording in setting forth our ideals. Our ideals may be epitomized sometimes in someone's else words, and thus brought home to us more forcibly than we would ordinarily conceive them.

I wish to heartily indorse the idea of our President as to the matter of commissions, and I think there will certainly be no dissenting voice to the passage of the resolution. I think Dr. Barnes's suggestions are good with reference to sending this resolution to the dental societies.

Dr. D. Willard Flint, Pittsburg. I want to add a word of testimony along this line. The only sleepless night I have had since I engaged in the practice of orthodontia was because of this commission business. When I started a year ago to specialize I "cut it out," and during that time never gave anything. Over a difference as to sharing fees I feel I have lost the influence of one man that I valued very highly.

I can not sufficiently express my delight that this has been brought up at this meeting. We talked it over around the dinner table at Chicago, and it was hashed and rehashed, but now we can see the solution to a serious problem, especially serious for the young man just beginning. I felt a great relief when it was brought up here, so that we can have some backing when we stand for what we consider a better standard of ethics.

Dr. H. A. Pullen, Buffalo. It is with much pleasure I listened to his very able address. The President brought out very prominently in his paper the subject of commissions, although he has at the same time presented before us our highest ideals and aims. I am sure we all feel grateful for the good he has done us with his Journal; I fear we are not half appreciative of this good. I believe the society could not have made the advancement it has in the past few years without the aid of ITEMS OF INTEREST, the pages of which have been given so willingly, regardless of the expense of the illustrations and text.

Concerning commissions, we all know we have made errors in the past, and I am sure from the applause to the remarks that have been made on this subject, that our hearts are all tuned to the same key in wishing to abolish the commissions absolutely from our practices.

I believe if the society takes this action, as recommended in the resolution of the President, and by motion, that it will be the first society on record to express itself in this manner, and in future we shall look back with much pride on the record established in this matter.

Dr. H. A. Baker, Boston.

I am glad the President has invited me to speak. I wanted very much to speak on this subject, but not being a member of the society I am situated much like the Scotchman who was groom for a gentleman. The gentleman went out to order his horse and found the Scotchman drunk. He said, "You are drunk!" No," the groom replied. The Scotchman then grew angry. He said, "I am not drunk. Got! I wish I was!"

I am much interested in the subject. I have been practicing orthodontia for thirty years. While not a specialist exclusively, I have for the past ten or fifteen years made it my exclusive work almost entirely.

The matter of commissions is a serious subject with me. I do not believe in commissions, but as stated by your President, there are two sides to the question. I may quote two cases that came under my observation. Something like fifteen years ago a dentist brought a case to me for orthodontic services. I told him, in reply to his question, that I did a good deal of that work. "What commission am I to get out of it?" he says. "What do you want?" was the reply. "What you usually pay." I said, "You are the first man who ever asked me to pay him a commission." He was disgruntled, and I lost the case.

The next case I recall was sent me by a friend only a few years ago. I asked if he wanted anything out of it. He said, "Doctor, I do not feel just as though I should take a commission, but a man can not turn over a case without giving it some of his time." There is some truth in that, too. I think the line to work along is to get the general practitioner to realize that it is unethical to receive a commission. There are many times when we would have to pay a commission or lose a case, provided Dr. Smith and Dr. Jones are paying commissions.

Dr. H. C. Ferris, Brooklyn.

I am heartily in accord with everything I have heard here to-day on the subject of commissions. It is of particular interest to me, as I am just starting in the practice of orthodontia as a specialty. I recently returned from Dr. Angle's School, and to say I am enthusiastic would be putting it very mildly. I have endeavored to practice orthodontia in the past, but as I look at my cases now, after my education in the

West, I feel my efforts have been almost lost. I am anxious, I almost feel, to take up the case of every patient I have ever worked for, and do the work over again.

Dr. F. C. Kemple, New York.

So far as experience in commissions is concerned, my own has been nil. I have never given a commission. When I came to New York to practice orthodontia I was somewhat at sea on this question. I did not know whether to give commissions or not. In this uncertain state of mind I consulted a dentist here in New York, and this gentleman told me that he had never accepted a commission. He said if a commission should be sent to him by a specialist he would return that portion of the fee to the patient, as he had done on one occasion, because he would feel that he had done nothing to earn that percentage, and if the orthodontist had been remunerated for his work by that portion of the fee which he had retained, the portion which had been paid as a commission was an overcharge which rightfully belonged to the patient. He therefore advised me not to pay commissions, but to take that much off the fee for the patient, and gentlemen, I thought his advice was sound.

I have located here in New York, and I pay no commissions nor divide fees, nor present the dentist who refers the case with a beautiful hunting or fishing outfit, because I believe the honest, conscientious dentist, who has ideals and lives up to them—and, by the way, there is a great difference between the man who preaches ethics and the man who lives ethics—does not want a commission.

In the case cited here this morning where the dentist picked up the little child who was playing in the park, and glancing at her mouth, told the father that the child should have her teeth regulated, if that man made two hundred dollars in that way it is an easy method of making money. I use the term "making money" advisedly, for this "professional gentleman" certainly did not earn the money through professional knowledge, skill, or service. It is clearly a case of accepting money without giving value received.

There may be some slight responsibility attached to the dentist who refers a patient to a specialist. If the specialist lacks ability and his operations result in failure it reflects unfavorably on the dentist who recommended him, but money does not compensate for such responsibility. The dentist should make it a point to know the ability of the specialist to whom he refers his patients.

I feel very much in accord with the sentiment expressed at this meeting in regard to the commission proposition.

Dr. O. W. White, Detroit. The resolutions as advocated by the President in his address to-day can not but meet with general approval from the society.

As I have just entered the profession of orthodontia, it is impossible for me to speak with experience on this subject.

I have talked with a number of orthodontists who have come to grief from this practice. My neighbor Dr. Watson tried the plan of giving commission for cases referred to him. He has told us of the embarrassing positions he has been placed in. When these conditions exist there must be something wrong, and if wrong should be stopped.

The only man who has advanced any sort of solution to this problem was Dr. Dodson, of Grand Rapids. A dentist is entitled to remuneration for time spent upon a case, and he may render a bill for service or consultation. But this bill or statement should go to the patient, not the orthodontist, as service was rendered to the patient.

It is very important that this question should be settled now before the evil grows, so that the professional standing of dentistry and orthodontia are not injured by it.

Dr. Ottolengui. I am more than ever proud of being President of such a lot of fellows. I want to discuss primarily the matter of the division of fees. There must be absolutely no such thing as the division of fees. On that point let me make my position perfectly clear. The dentist, in a technical sense, makes a division of fee with the laboratory man when he sends a certain portion of a given piece of work to the laboratory to be done, and the patient knows nothing about it; often he does not even know the laboratory assistant; there is an agreement between the dentist and the laboratory man to do a certain share of work for a certain sum of money, but it is no division of fee; that is paying the laboratory man for specified work. The responsibility remains with the dentist.

In the course of your work if you find it necessary to have something done by a dentist in the mouth of your patient for which you are responsible, you must pay the dentist for it. Make no division of fee, but pay the dentist his fee for the service which he renders.

There is only one circumstance where I can imagine a rightful division of a fee. That is where a dentist is taking care of a patient in an adjacent town; he has some capabilities but he wants your supervision of the work, your advice, and wants you to put on the appliances and tell him what to do. You should send the bill for your services to the patient; and the dentist should send the patient his bill for his work.

Some Considerations in Retention.

HERBERT A. PULLEN, D.M.D., Buffalo, N. Y.

The earnest workers for the advancement of orthodontia along scientific lines, have recognized for some time past the undeveloped possibilities in the field of retention of corrected malocclusions. To realize that improvement in technic and method in the construction of simple, efficient and esthetic retaining appliances is a great present necessity, we have only to observe the numbers of failures which are daily called to our attention.

In my opinion, there are three reasons for this state of affairs; first, because the rapid strides of diagnosis, prognosis, and treatment have outstripped the latter consideration of retention; second, the advancement in retention methods have been made by individuals, and no systematic collection and arrangement of the various individual methods has been attempted; third, it has taken some time to reduce the complicated retaining devices of the past into simple mechanisms with an efficiency viewed from the standpoint of retaining of the normal relationship of the inclined planes of the cusps of the teeth in occlusion.

The importance of the retention problem naturally increases with the progress of treatment toward perfection, and it requires the same minute attention to detail and method.

Experience is really the best although the hardest teacher, for the first failure of the novice will force him to realize the value of the mechanical principles of force and resistance, of physiological laws of growth and development of alveolar processes, of art and esthetics.

Surely, the attainment of the ideal in occlusion and facial harmony ought to be enough to ask of the skill of the operator without the extra problem of retention, with all its vagaries and complications.

Truly, we can say that orthodontia is not only an exact, but an exacting science, in its demands upon the knowledge and skill of the humble delver into its mysteries.

It is with a great deal of pride that I can say that I believe the greatest advance in the developments of retention methods has been made by the American Society of Orthodontists, through the individual and organized efforts of its members to attain perfection in method and results in their chosen field.

Much has been said and written about the ease with which the ready made appliances may be adapted, and many individuals believe that the science of orthodontia consists in the simple application of the arch and molar bands, and that the restored occlusion is retained in this condition by virtue of its own temporary integrity or perfection without further mechanical retention.

Such a cramped conception of the requirements of orthodontia belongs only to the novice and the inexperienced, who learns only through failure to secure results and maintain them, that orthodontia is a science which requires an unusually high order of skill and ingenuity, and an extended knowledge of its mechanical and physical aspects by those who practice it successfully.

A rather late realization of the truth often comes to the beginner, when after dismissing a case with perhaps no retention at all, or at least an inefficient apparatus, the return of the malocclusion causes him to reflect on the wisdom of foreknowledge of the requirements of retention.

Just at this point I wish to lay especial emphasis upon one fact: *although normal occlusion is attainable in the correction of malocclusion, it can not be depended upon for retention except in simple and special cases, or after varying periods of fixed retention of the teeth and arches with appliances especially constructed for the purpose.*

At least we can congratulate ourselves that retention is a field in which the ready-made appliance has little, if any, use, and that in its varied characteristics of mechanical construction, the individual can give scope to his ability in the attainment of perfection, in the mechanical artistic and esthetic features which the lover of the art alone can enjoy.

Where, except in a previous practice of dentistry, consequent upon a college training in the principles of dental science, can the young man entering the field of orthodontic practice, hope to receive that training in mechanics which will enable him ever to rise above the mediocre in his ability to construct the often times necessarily complicated retaining appliances?

Is the M. D. degree alone any guarantee of the mechanical fitness of an applicant for admission into your rank? Is it even a guarantee of his fitness as an oral surgeon, possessed of sufficient knowledge of dentistry to enable him to understand the diagnosis and treatment of the simplest untoward symptoms which might develop in the care of a case of malocclusion?

Experience has already answered these questions in the negative, and the time is soon coming when these notions will disappear like the fog under the sun's rays, through a clearer perception of the requirements of the science of orthodontia.

Importance of Retention.

Retention of teeth and arches which have been restored to normal relations of occlusion is as important in its bearing upon the success of the work of the orthodontist as the treatment itself, since in almost every case it is a necessity for the permanence of the result, both of occlusion and of facial harmony.

Many an otherwise successfully conducted case has come to failure because the principles of retention were not understood, or else were intentionally ignored.

In the first place, the retention of a corrected malocclusion is a matter of more than a few weeks in point of time, usually, many cases requiring months and some of the more severe, several years of fixation in order to overcome the resistance of the fibers of the peridental membrane and the tendency of arches to contract and assume their original shape after expansion and other operations thereon.

Retention may be defined as the maintenance of sufficient antagonism to the forces tending to cause the return of a corrected malocclusion to its original condition, to ensure the permanence of the normal relationships of occlusion which have been established.

If the forced effort to return is greater than the antagonizing resistance of the retaining apparatus, the retention can not be perfect and more or less return of original malpositions of teeth and arches may be expected. An equilibrium of these forces must be maintained in order to secure proper retention.

There are two principles in the consideration of the retention of the teeth which should be studied in every case; viz., the physiological and the mechanical, the former dealing with the changes during and subsequent to tooth movement, the stage of development of the arches, the resistance of the fibers of the peridental membrane, and the varying

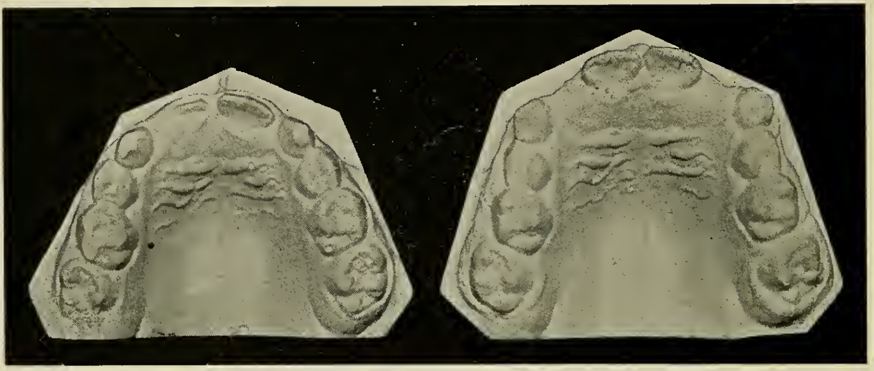


Fig. 1.

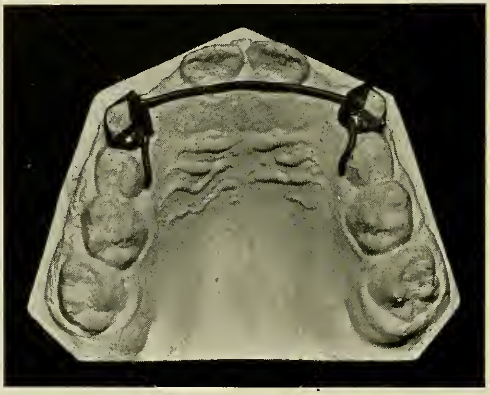


Fig. 2.

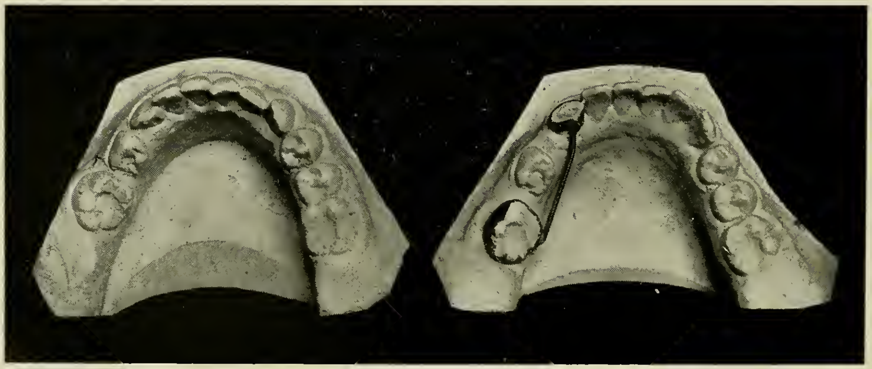


Fig. 3.

densities of the alveolar processes, etc., and the latter, with the study of resistance to return tooth movements and the construction of the simplest and most efficient appliances which will answer the requirements of retention.

The alveolar processes being superimposed upon the underlying bone of the maxilla and mandible, and continuous in development and resorption with the development and loss of the teeth, concerns us chiefly in the study of the physiological changes in the tissues surrounding the moving teeth.

Retention During Development.

It is reasonable to suppose, from the rapidity of development of the alveolar processes during certain stages of the eruption of the permanent teeth, that the movement of the teeth at the time when these changes are taking place, conforms most nearly to a natural and physiological process, and that the amount of absorption of alveolar processes in advance of moving teeth is comparatively slight, the change in these structures being analogous to the natural developmental changes which would occur in case no malocclusion had existed.

For example, at the age of six years, that being the stage of development of the arches in the treated case in Fig. 1, any expansion of the arch, or gaining of sufficient space for the eruption of the developing permanent teeth, serves only to assist Nature in her own retarded developmental processes, which through some slight cause, either local or remote, have not been uniform nor sufficient for the accommodation of the teeth which may be ready to erupt.

The more experience the orthodontist has in correcting malocclusion of the teeth of children, or in its prevention, by simple and painless operative methods, the more does he become convinced of the manifold advantages to be derived from the treatment of these cases prior to or during the stage of rapid growth that is exhibited during the eruption of the permanent teeth and the development of the alveolar processes at this time.

Whatever may have been the immediate or remote cause for the arrest of development in the anterior part of the arch shown in the left cast in Fig. 1, it is certain that the restoration of the spaces for the eruption of the permanent laterals, and the mechanical widening of the arch, most nearly simulates Nature's efforts to produce that growth and development which should be normal in the case.

In other words, we can not consider the operation of expansion in this case, as shown in the cast on the right, to be an unnatural widening or enlargement of the dental arch, but simply an assistance to a natural development otherwise unattainable through arrested developmental conditions.

It is often noticed in cases of this kind that the tissues in the immediate neighborhood of the operation begin to develop quite rapidly, and many times an erupting tooth which has been arrested at a certain stage by reason of the undeveloped condition of the arch, will begin to erupt very rapidly during the period of expansion and making of room for it in the arch.

One principle which should be observed in these early operations is the gaining of more than sufficient space for the accommodation of the erupting teeth, as more or less space is lost through the settling back of the teeth after expansion, even with the retaining appliance in position, so that what was apparently sufficient room by actual measurement for a developing permanent tooth, would be found to be slightly diminished and inadequate for the placing of this tooth in its proper position in the arch.

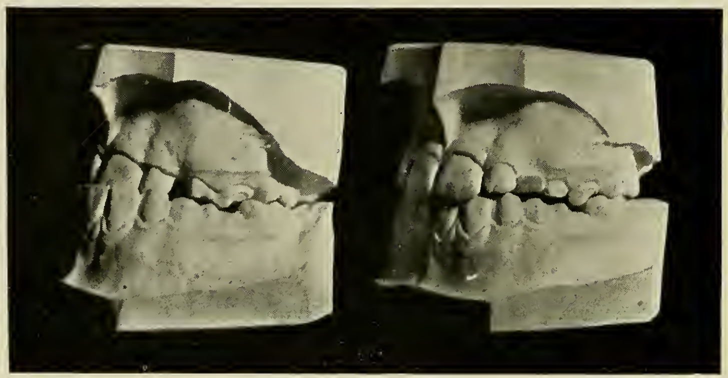


Fig. 4.

This condition of affairs must be taken into account in the retention of these regained spaces, and an appliance used which will most perfectly answer the requirements of fixation of the positions of the adjacent deciduous teeth which have been moved to make room for the eruption of these permanent teeth.

An appliance which will efficiently retain the anterior part of the arch during the developing period, and attached entirely to the deciduous teeth, is shown in Fig. 2, being the retention of the anterior part of the arch of the case shown in Fig. 1. A great amount of strength in a retaining appliance attached to the deciduous teeth is never necessary because of the slight resistance they afford to the action of force appliances in their movement, due to their small short roots, and the cartilaginous nature of the alveolar process during their dentition.

As the retention of the deciduous teeth is only a temporary affair, such retention should be under the watchful care of the operator at frequent intervals, so that on the early indications of the absorption of the roots of the deciduous teeth supporting the retainer, the appliance may be removed and reconstructed upon other teeth whose rigidity will be of sufficient duration for the permanence of the result established by the operation.

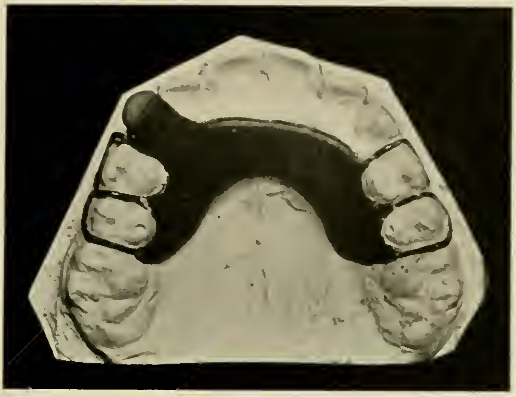


Fig. 5.

There is also this difference between the retention of the deciduous teeth and the permanent ones; retention of the deciduous teeth is a process of temporary fixation for development of the arch alone, while retention of the permanent teeth is often a necessity for the maintenance of them in their relative positions in the arch, regardless of development, although, of course, the permanent teeth are also retained in certain positions for the purpose of securing development of the arches when necessary.

In the cast on the left of Fig. 3, it will be observed that the second deciduous molar on the left side of the arch has been prematurely lost, and its space closed up in the manner usually followed in such cases, there being insufficient space for the eruption of two bicuspids between the permanent cuspid and first permanent molar on that side.

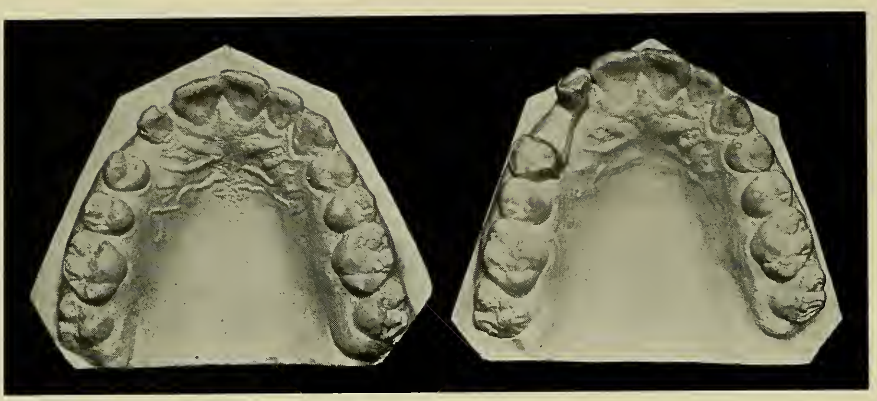


FIG. 6.

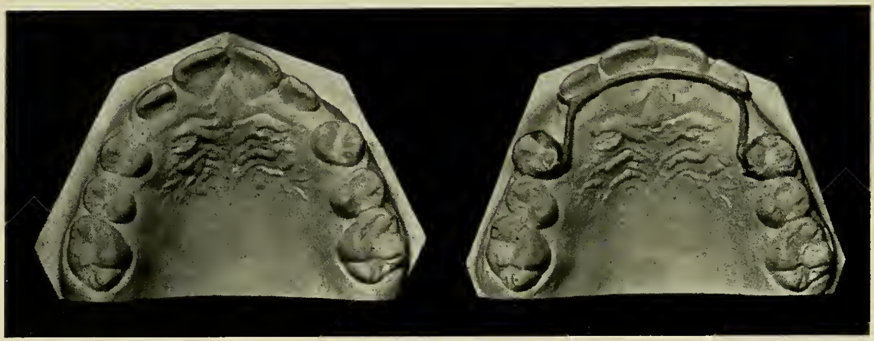


FIG. 7.

The retention of the regained space after operation may be noticed in the cast on the right, both cuspid and molar being banded and a strong bar soldered to the lingual surface of each band, the whole being cemented in position until the eruption of the bicuspids.

It is a well known fact in orthopedic and orthodontic practice that the rapidity of the restorative or building up process in bony tissues, as after setting of fractures, is proportionate to the degree of fixation of the parts during the period immediately following the corrective operations.

To the end, therefore, of shortening the time of retention as well as obtaining a more perfect development and greater strength of the tissues surrounding the moved teeth, and avoiding the possibility of any loss from contraction of arches after expansion or of regained spaces. the fixed retaining appliance, with cemented bands, is now generally to be preferred to any other.

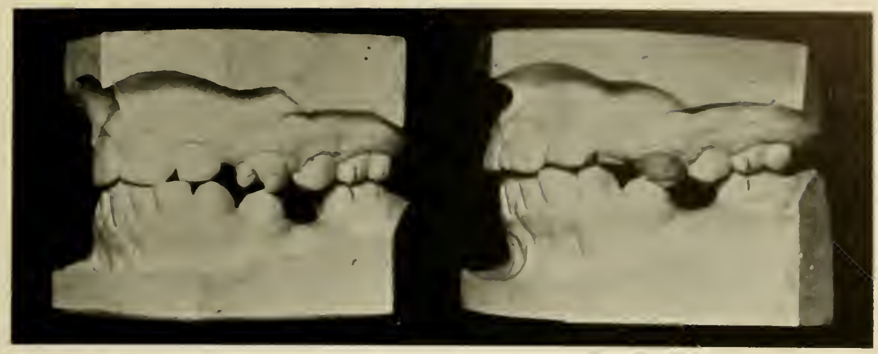


FIG. 8.

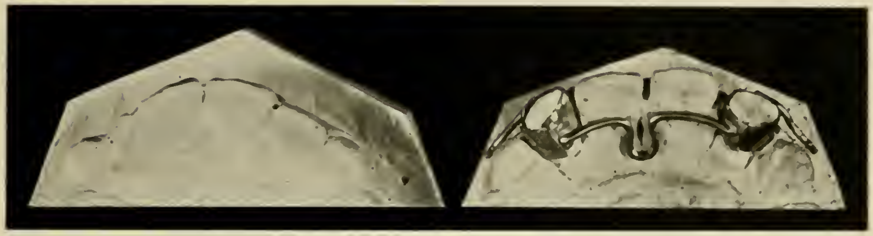


FIG. 9.

Roof-plates. To illustrate, in the past, the removable roof-plate, as seen in Fig. 4, with spur extending out through the space regained for the cuspid, was long considered efficient for the temporary character of the retention, as the occlusion was sufficient to retain the four incisors and very little tension was required to hold the space open for the cuspid.

After continued trials of this plate, the writer was compelled to give up its use, because of more or less loss of the space gained for the eruption of the cuspids, and the inconstant and unreliable pressure exerted by an appliance which was retained in position only by suction, or a couple of tiny spurs imbedded in the plate and extending into the interproximal spaces between teeth on opposite sides of the arch.

A removable plate which is efficient to a greater degree, in similar cases, is shown in Fig. 5, the Jackson spring clasp attachments serving to make the plate remain in position very firmly during the time necessary for the cuspid to erupt. An artificial tooth attached to the rubber spur which extended through the cuspid space, gave an esthetic appearance to the appliance when in position.

Although the writer finds an occasional place for the use of the roof plate with the spring clasp attachments as shown in the cut, a fixed retention with bands and spurs has proven much more satisfactory.

Fixed Retainers.

An exactly similar case in Fig. 6, exhibits a retaining appliance, which, by having two cemented bands connected by a strong spur, leaves no question as to the constancy of fixation and perfect retention of the space for the unerupted cuspid.

A little more esthetic, perhaps, in its construction, and fully as efficient, is a fixed retention from one first bicuspid to the other, in Fig. 7, retaining the regained spaces for the eruption of both cuspids. Bands are cemented upon both of the first bicuspids, having previously been united with the strong 16 gauge bar of clasp metal extending along the lingual surfaces of the incisors, and having spurs of 21 gauge (B. & S.) clasp metal bent around the distal angles of the lateral incisors to the labial surface to hold the four incisors intact.

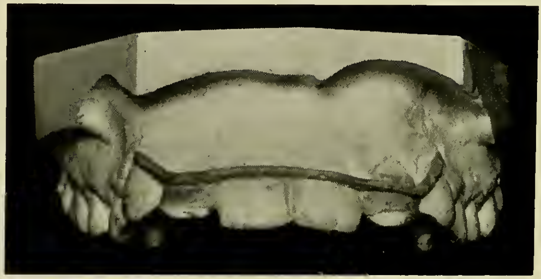


FIG. 10.

This appliance is as simple and esthetic as can possibly be constructed for a case of this kind, and the writer believes that it could well be used as a standard retention for similar cases in which no rotation of any extent is necessary in the incisor region.

The left side of the case in occlusion, before and after treatment, is shown in Fig. 8, and one is struck by the inconspicuousness of the retaining appliance from this view.

In confirmation of a theory which has long been held by many writers on orthodontia, I have collected, in one case, at least, sufficient evidence to warrant a firmer belief in certain physiological processes occurring after tooth movement, which are of intense interest to the orthodontist, especially in the consideration of certain features of retention which have puzzled the ablest and most acute observers of the functional disturbances coincident with tooth movement.

In an operation on a thirteen-year-old boy for the extraction of a supernumerary right lateral incisor, and its replacement by its natural substitute, whose position in the arch the supernumerary had usurped, there were taken three X-ray pictures of the seat of the operation between the right central incisor and right lateral incisor, representing three stages which might be of scientific value in the study of bone changes coincident with orthodontic operations, one being taken at the beginning of treatment, the second, after extraction of the supernumerary and correction of the malocclusion, and the third, being six or eight months after a period of fixed retention of the normal lateral in its proper position.

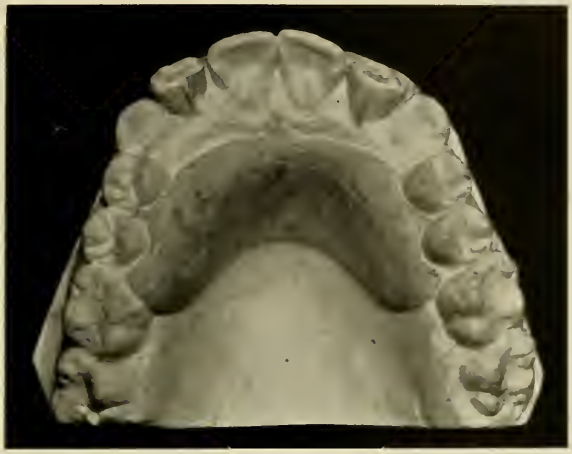


FIG. 11.

The first radiograph exhibited the normal relationship and density of the bony tissues between these teeth; the second, considerable absorption of tissue after the extraction and the breaking down of tissue ahead of the moving lateral; the third, a very complete and perfect reconstruction of the bony septum intervening between the central and lateral after the fixed retention, for a period of at least six months, of the normal lateral.

Although this evidence of bone reconstruction after resorption has been carried out in but the one case, it is a source of some satisfaction to observe the working out of Nature's processes through the medium of the X-ray, especially if they are confirmatory of theories which we know must be true in order that a permanence of the results obtained by orthodontic operations may be assured.

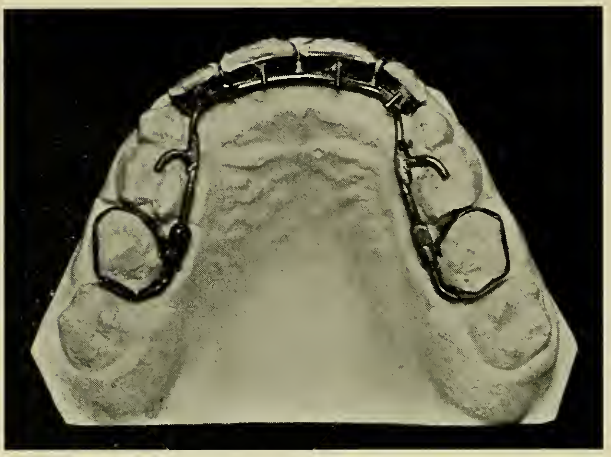


FIG. 12.

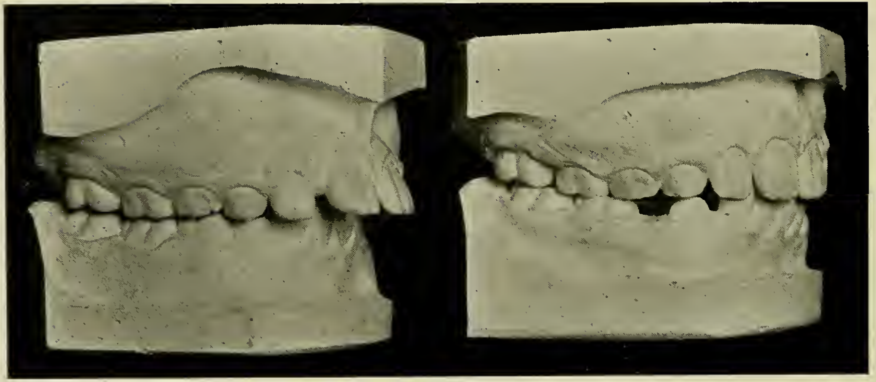


FIG. 13.

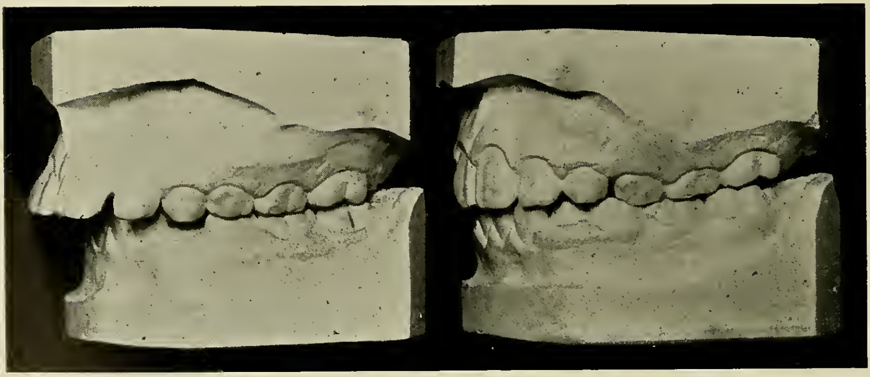


FIG. 14.

We have become accustomed to divide the retention of the individual arches into the portions anterior and posterior to the cuspids, retaining the alignment of the incisors with a fixed retaining apparatus, and the enlargement of the arches after expansion with a removable apparatus, usually in the form of a plate.

The average case requiring this method of retention is represented by a contraction of the anterior part of the arch, with the cuspids outstanding, the usual retention of the incisors and cuspids being an appliance consisting of two bands upon cuspids, united by a strong lingual bar touching the lingual surfaces of all of the incisors.

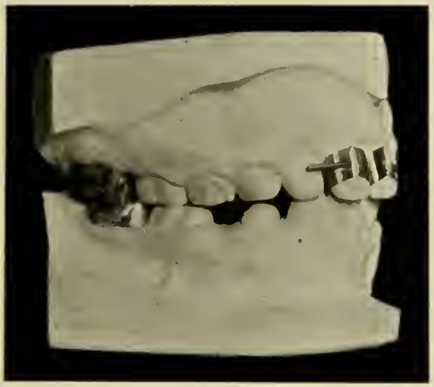


Fig. 15.

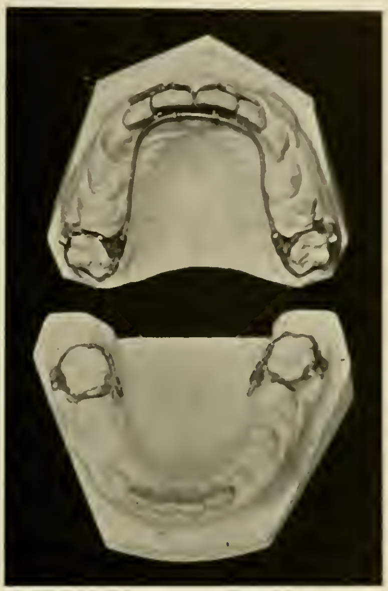


Fig. 16.

Whereas this appliance is effective in many cases, in others it does not seem to answer the purpose as well.

For example, in Fig. 9, the retention of the anterior part of the arch is obtained by banding the laterals, extending labial spurs over the cuspids to keep them in place, and a lingual looped wire from one lateral band to the other, the loop answering the purpose of allowing the spaces between the incisors to be closed up during the first few days of retention and bringing a pressure to bear upon the labial surface of the cuspids sufficient to keep them in alignment.

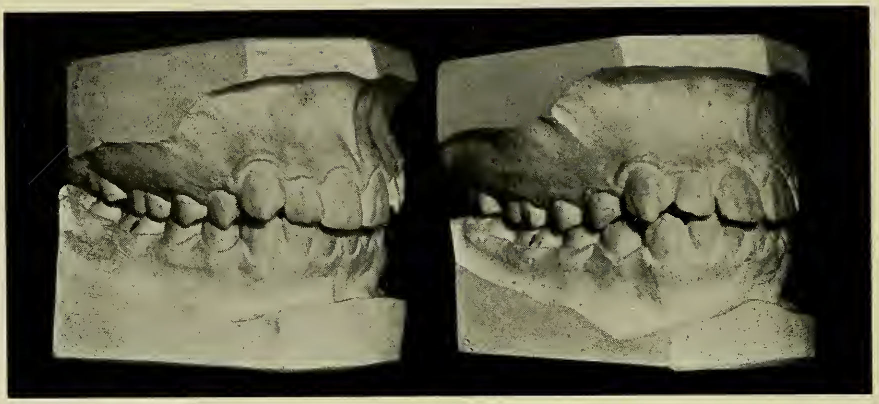


Fig. 17.

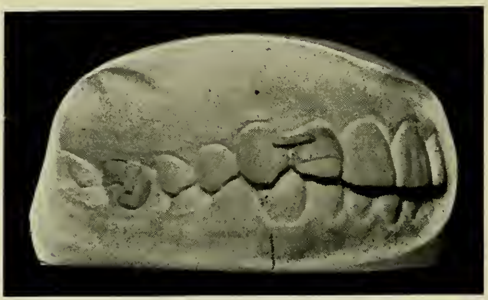


Fig. 18.

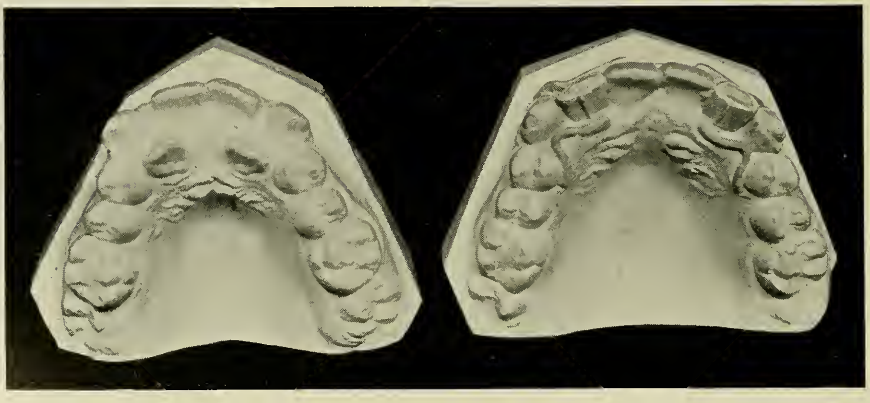


Fig. 19.

The loop is contracted by means of a pair of round nosed pliers which can be made to bring pressure on either side of it.

A variation from this appliance for the purpose of retaining the anterior part of the arch is seen in Fig. 10, the laterals being banded, and the bands connected upon the labial surface by the retaining wire which also passes over the labial ridges of the cuspids. Advantage can be taken of the settling backward of the incisors with this appliance in position, to bring sufficient pressure to bear upon the labial surfaces of the cuspids to keep them harmoniously aligned, a feature which is not possible in the usual retention from cuspid to cuspid, the bands upon each of these teeth being connected with the lingual base wire.

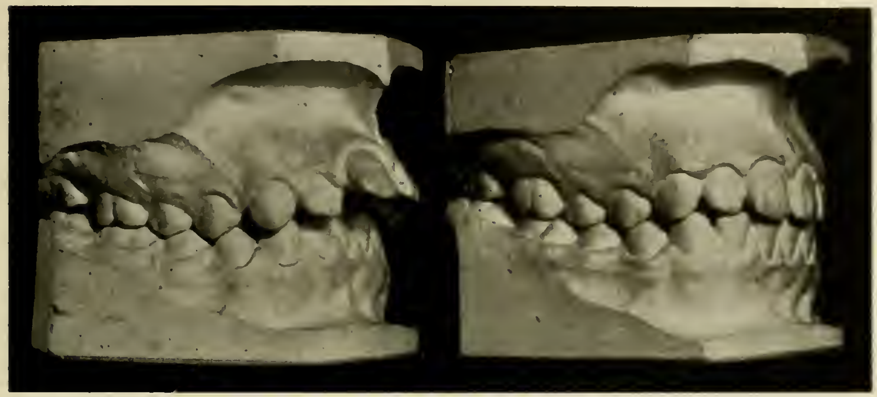


FIG. 20.

Its worst feature is conspicuousness, which will offset its otherwise good qualities.

The retention of the posterior part of the arch after expansion is usually accomplished with the removable roof-plate, which, although not conforming to the laws of fixation of a retaining appliance, seems to have been more or less popular on account of its easy construction and adaptation.

In the form shown in Fig. 11, the roof-plate depends upon adhesion and small wire extensions into the interproximal spaces between the bicuspids for its support, relying upon the laterally inward pressure of the arch to return to its original position to assist in retaining the retaining appliance, a rather unreliable support in view of the inconstancy of position of the appliance.

The roof-plate in this form often fails because of the great pressure of the return forces causing it to slip out at one side, when its usefulness is over.

It can be made effective to a greater degree by the addition of the Jackson spring clasp attachments around bicuspids or molars on both sides as the case may need.

Lingual Arch Retainers.

The use of the lingual arch for retention, as suggested by Dr. Lourie, invites many possibilities of artistic and esthetic retention of the teeth.

In Fig. 12, its use in retaining the incisors from going back into their sockets after being elongated is effective, especially with the spur over the occlusal surfaces of the deciduous molars to assist in the support of the lingual arch in position.

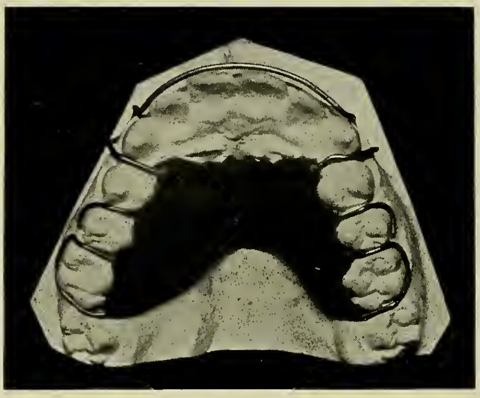


Fig. 21.

The arch is soldered at either end to the ends of the lingual screws of the molar clamp bands which in this case were placed upon the second deciduous molars.

Following closely the curve of the arch, the lingual wire passes under lugs soldered to the lingual surface of the incisors, and the molar clamp bands with the lingual wire are first cemented into position, and then the incisor bands are filled with cement and slipped between the teeth and the wire and forced into place.

The retention of incisors which have been rotated may be accomplished by the lingual arch method by attaching spurs to the lingual angles of bands upon the incisors which have been rotated, mesially or distally according to the direction necessary to overcome the return tendency, these spurs to be bent around the lingual arch in such a way that they are very firmly attached.

Fig. 13 illustrates the right occlusion and Fig. 14 the left occlusion, before and after treatment, of a case of Class II, Div. I (Angle), the patient being nine years of age, and having the deciduous cuspids and molars still in position.

It is a good plan to retain these cases until the permanent cuspids and bicuspids have erupted into occlusion, so as to get the benefit of the retentive force of their inclined planes in occlusion.

A buccal view of the retaining appliances used in this case is shown in Fig. 15, the upright spurs upon upper and lower molar bands serving to retain the normal mesio-distal relationship established between the arches, and the bands upon the incisors acting in conjunction with a lingual arch, effectually retains the upper incisors in their normal positions.

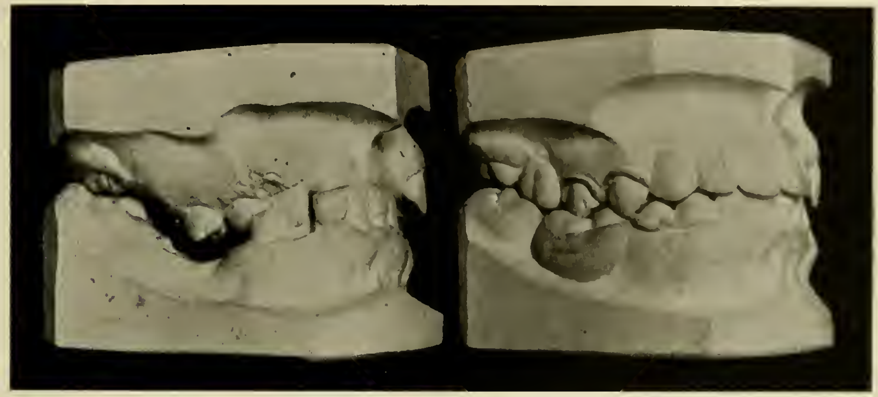


Fig. 22.

The buccal spurs upon the molar bands are constructed of square German silver wire, which is admirably adapted to this use, as it gives flat surfaces for the sliding of the inclined planes of the two spurs when antagonizing during occlusion.

A view of the lingual arch wire in position on this case is seen in Fig. 16, attached to the ends of the screws on the molar clamp bands, and following the curve of the arch accurately close to the necks of the teeth, and in the incisor region, having attached to it by small wire spurs bent around its circumference, the two incisor bands, which, with the addition of spurs upon their labial surfaces extending over the laterals, retain the four incisors from moving forward.

These retentions are rather difficult to make, but that they must come into general use for reasons of esthetics and efficiency, seems probable at this writing.

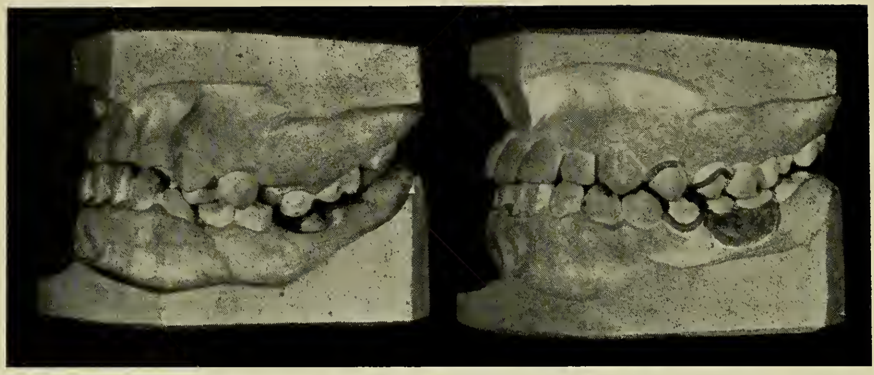


FIG. 23.

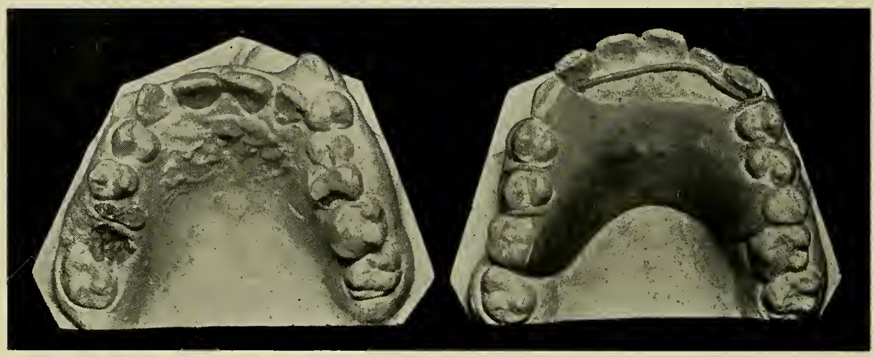


FIG. 24.

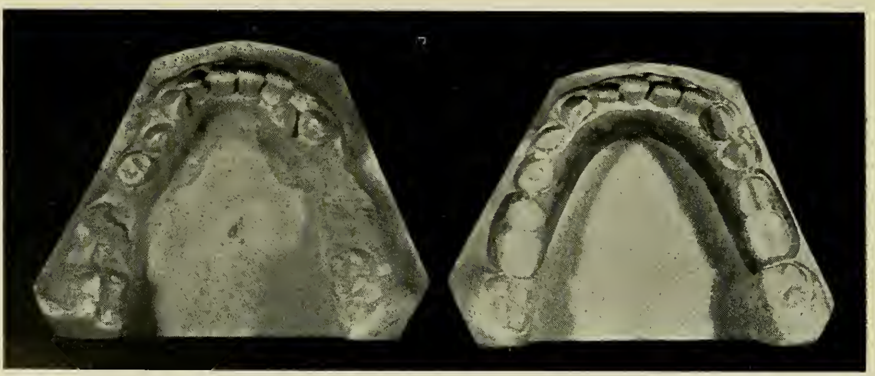


FIG. 25.

Fig. 17 illustrates the before and after treatment models of a case of Class II, Div. 2, subdivision, in which there has been a shifting of the occlusion on the right side only from distal to normal.

A unique feature of the retention is the spur extending from the band upon the right lateral incisor over the labial surface of the cuspid (Fig. 18), which assists in retaining the upper cuspid and bicuspids on the right side from moving forward. The band and spur also serve to keep the lateral from rotating, for which purpose it was originally intended.

The interlocking spurs upon the first molars retain the corrected occlusion in the molar region.

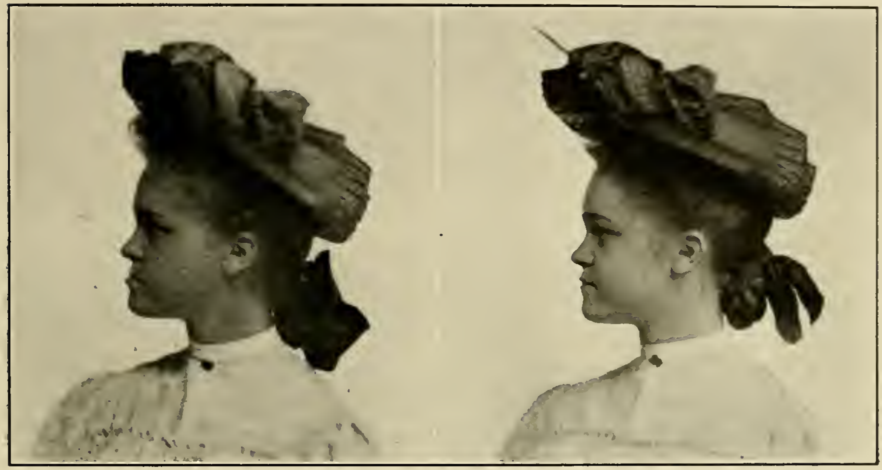


Fig. 26.

The retention of laterals which have been inlocked is sometimes difficult owing to the lingual inclination of their roots immediately after their movement into alignment, and their tendency to slip back into their former positions inside of the arch.

In a case like that shown in Fig. 19, the usual cuspid to cuspid retention has proven ineffectual in the writer's practice, it being found necessary to band both laterals and cuspids, with labial spurs upon the lateral bands extending over the adjoining teeth, and lingual spurs upon the cuspid bands, extending over the lingual surfaces of both laterals and bicuspids. This retention is not permanent, as the full development of the anterior part of the arch has not taken place, but it answers the purpose of effectually holding the lateral incisors in place until such development has occurred as will place the roots of these teeth in their proper relationship with those of the adjoining teeth, when a slight readjustment of the anterior teeth may be necessary.

The retention of the protrusions of Class I has always proven a difficult matter, but the favorable results from the lingual arch attached to incisor bands in Class II, as in Fig. 16, seem to indicate that the same retention can be used to advantage in a protrusion of Class I, Fig. 20, where the added strain of buccal spurs for retaining the molar occlusion need not be reckoned with.

Up to the present time, the retention of this class of cases in the writer's practice has consisted of a removable plate, Fig. 21, with spring clasp attachments on molars and bicuspids, and a spring wire extending around the cuspids and incisors, and capable of being so adjusted that a slight tension is kept upon the incisors during the time it is worn.

There are some cases occurring in practice which seem to be exceptionally difficult to diagnose and treat on account of the loss of many of the permanent teeth, and the consequent complications caused by the elongation of teeth, and contraction of arches, etc.

Such a case is exhibited in Figs. 22 and 23, before and after treatment, with retaining appliances in position in the after treatment models. Here, as in the previous case, the plate, with spring clasp attachments, plays a very important part, not only in retaining spaces regained for permanent teeth, but also supplying artificial substitutes attached to the plate itself.

A view of the upper casts of this case in Fig. 24, shows the retention of five of the anterior teeth with the lingual spur from lateral to cuspid, and a roof plate, with spring clasp attachments and three artificial teeth, effecting the retention of the rest of the arch.

Another plate with spring clasp attachments and artificial substitutes for natural teeth which were missing, accomplishes the greater part of the retention of the lower arch as seen in Fig. 25, in position in the cast on the right.

The profile of this case, before and after treatment, is exhibited in Fig. 26, as illustrative of the effectual retention of the normal position of the teeth and arches by the appliances just shown in position on the casts.

In extreme cases of Class II and III, the continued use of the intermaxillary elastic from one arch to the other for an indefinite period is proving an efficient aid in those cases in which the usual methods of retention does not seem adequate. These elastic bands are so adjusted that they will just counterbalance the tendency of the arches to return to their positions of mesial or distal occlusion.

Discussion of Dr. Pullen's Paper.

Dr. Alfred P. Rogers. I regret that Dr. Angle is not here to discuss this very interesting paper. I shall try, however, to present a few ideas from my own experience which may be of value. I believe it is well to emphasize the great importance of retention; because so many have become interested in orthodontia and have allowed those prominent features of art and occlusion to occupy their minds to at least the partial exclusion of this very important feature. Many general practitioners are interested in this work, some failing utterly to appreciate the value or necessity of proper retention. The glowing features of treatment have occupied their attention almost exclusively, and cases are undertaken and treated with absolutely no attention given to retention, which, if not understood and properly applied, renders the work worse than worthless, because our efforts have been spent in vain, and months or years of valuable time wasted.

In order to bring the subject of retention clearly before the profession, it seems to me that we must agree upon certain definite principles, just as we do in the treatment of malocclusion. Dr. Pullen very wisely referred to the age problem, and I am going to emphasize what he has said by insisting that we shall commence treatment in the early stages, if necessary in the temporary set, guiding the permanent teeth gently into their proper places; then when they erupt the interlocking of the cusps affords an efficient and permanent retention. Multitudinous movements to which the teeth are subjected in pronounced cases makes the matter of anchorage during retention a subject to tax our most careful and sincere thought.

The idea presented by Dr. Abell regarding the restoration of spaces for teeth not yet erupted appeals to me, because in the establishment of retention we sometimes realize the fact that greater growth will take place for the admission of the teeth that are to come; therefore in placing retainers where the anterior teeth have been moved into occlusion and the first molar is in position, the lingual wire should be so constructed that it may be stretched to give ample room for the bicuspids and cuspids to come later.

It is undoubtedly true that we learn most through our failures. This idea calls to my mind a case of the third class which I once treated, in which the entire upper arch was in lingual occlusion with a lingual tipping of the molars and bicuspids of the lower arch, although the arch was of normal size. The restoration of occlusion was accomplished and the upper arch which was greatly expanded was retained by means of a rubber plate, which was kept in position for eighteen months, but gradually with the settling of occlusion the lower arch showed still greater expansion until the upper teeth were again slightly in lingual occlusion although they had not changed their position. This shows the great force of the inclined planes and how important it is that they should be placed and retained in their correct positions. This case was a partial failure, but it carries with it a valuable lesson.

In the retention of the second-class cases Dr. Howe of Boston spoke to me of a very efficient aid in dealing with these cases. The idea was to band the lower bicuspids, attaching thereto a spur extending between the inclined planes of the upper cuspid and first bicuspid. Regarding the retainer for which Dr. Lourie is given credit, I would like to say that I have elevated anterior teeth and retained them in this manner, but have noticed that sometimes the molars have tipped slightly, allowing the anterior teeth to settle slightly. This may be overcome by extending a spur between the cusps of the second bicuspids, making its attachment on the molar band.

Dr. Lourie. Where the upper incisors have needed to be considerably depressed in their sockets, I have re-enforced the molar anchorage by attaching to the first bicuspid as well.

Dr. Rogers. I think that would be an efficient means, myself. There are men here of very much more experience, and I should like to give way to them for the further discussion of this paper.

Dr. Abell. I have found we need more room for the permanent bicuspids and cuspids than we have between the first permanent molar and permanent lateral. The temporary teeth do not allow of enough space.

Dr. Young. I have measured a great many teeth, and am satisfied that the combined widths of the deciduous cuspid and molars is sufficient to accommodate the cuspid and the bicuspids when they come in; that is by actual measurements in hundredths of an inch, and I believe Drs. Hawley and Watson will bear me out.

Dr. Hawley. I think Dr. Young is right. The second temporary molar, as you know, is considerably wider than the second bicuspid; also the permanent cuspid is wider than the temporary cuspid. So you have one permanent tooth wider than the temporary, and one temporary tooth wider than the permanent one, but there is very little difference in their combined widths, where I have measured. I think it just about adjusts itself, if the temporary teeth are normal. It would be safer of course, if there were a few hundredths of an inch greater space than needed, and in most cases there is.

Dr. Ottolengui. When you have first molars in place, and your four incisors erupted, that portion of the bone is usually full grown; otherwise we would be obliged to take into consideration the question of whether there would be an additional space between the first molars and lateral incisors for the accommodation of these teeth. Evidently these gentlemen think not, because they are simply measuring the temporary teeth and expect the permanent teeth to fill the same gap.

There is this fact: that the second teeth erupt in a little larger circle, and consequently there is a little additional space gained in that way.

Dr. Baker. It seems to me that you are getting this question of space down pretty fine.

What is the objection to getting all the space you need and even more? It does no harm, for as soon as your teeth are in place the other teeth will settle right back until they are held by contact. It is my rule to carry the teeth a little beyond sufficient space to bring the teeth into line.

Dr. Abell. This very point has been one I have experienced much trouble with, and I believe Dr. Baker is right in what he says about gaining a little more room Sometimes if we try to retain the incisor teeth in that position, we will have more or less space, and this afternoon I want to show you in my clinic a little device I have used to allow for the settling back of those teeth without changing the retention.

Dr. Visick. From the few cases I have made measurements of, I have found that the combined widths of the first and second temporary molars and the canine is more than the combined width of their permanent successors. We know that if the temporary molars are prematurely lost, the first permanent molar moves forward. This movement also occurs in the few months elapsing between the loss of the second temporary molar and the eruption of the second premolar. The greater width of the temporary teeth, as compared with the width of the permanent successors, would seem to be to allow for this encroachment on the space by the forward moving first permanent molar.

Dr. Henry A. Baker. Although the title of Dr. Pullen's paper is on retention he said very little about retaining fully corrected dentures, and it is on this line that I would like to say a few words. I have given retention a great deal of serious thought and there are a few points that I have discovered in my thirty-five years' practice which are of vital importance. First, that it is more difficult to retain teeth without injury to them than it is to bring them into their proper position.

Second, it is very desirable that retainers should be so made that the corrected cases will improve during the period of retention, and not move in the wrong direction, for the reason that it is about impossible to regulate so that all teeth will be in perfect occlusion at the time of putting the retainers on.

Third, that portion of the retainers that rests against the teeth should cover as small a surface as possible to prevent the accumulation of secretions, hence lessening liabilities of decay.

Fourth, it is very desirable to have retainers made so as to be adjustable by the operator with as few number of bands as possible around the teeth.

Fifth, that it is not wise to have removable retainers for the reason that the patient is apt to remove them too often and leave them out too long at a time.

Probably the most common as well as the most undesirable retainer is a rubber plate fitted closely around the teeth. This to my mind is the most injurious of anything that could be used, especially for young children. Not but that they hold the teeth in position, but the injury they cause to the teeth is the objection. I have seen teeth nearly ruined from decay by this use.

Last, but not least, retainers should be so made that as little as possible should be visible and that portion that is exposed not unattractive.

Dr. Ottolengui. I wish to throw out a suggestion. Dr. Pullen raises the point that it is always a question as to how long retention should be continued. A good solution for all cases is this: Begin the retention with a fixed appliance in practically all cases, and when you think you can dispense with that appliance, to be worn at least every night, and I usually say to the girls "wear it until you get married."

Dr. Varney E. Barnes. I desire to commend what the doctor has said on early regulation. Early regulation is one of the greatest factors in retention. Our best retainer has been said to be the permanent alveolar bone. To go a step further I would say that the best retainer is the first alveolar bone deposited about the tooth. In order to get this we should begin our regulation before the eruption of the lower central incisors. This means the regulation of temporary teeth, and the mechanical production of spaces that should have been growth spaces. Many orthodontia cases are shown as corrected when they are not; the full interapical spaces have not been restored. We get this space best by early regulation, that is, by doing what nature did not do. Many of our cases do not retain because we depend too much on the alveolar bone about the incisor teeth. This is the weakest alveolar structure in the mouth and we have been calling upon it to do too much.

I have been studying the development in temporary arches, and have come to some conclusions, which I shall quote from an article in the *Dentist's Magazine,* December, 1906. "Many observations taken in the past four or five years seem to indicate that in the normal temporary dentition in a child of about four or five years, the following law prevails:

"The central plus space distal to it equals the width of the permanent central. The lateral plus the space distal to it equals the width of the permanent lateral. The cuspid plus the space distal to it equals the width of the permanent cuspid. In some instances the temporary tooth plus the space distal to it may be a little broader than the width of the succeeding permanent tooth, but it is never less, in the normal individual. This law seems to be corroborated by the fact that the first and second temporary molars are succeeded by teeth of less width. The wise intention of Nature being to provide sufficient space for the normal formation and eruption of the permanent teeth, not only the bicuspids and molars, but also the incisors and cuspids, development of the dental arches takes place in the three directions which are of vital significance to orthodontists These are: The antero-posterior, the buccal and the vertical.

"The antero-posterior and the vertical developments are not completed entirely until maturity, the third molars marking the completion. The buccal development seems to be complete in the child detention at from four or five years of age, back to the first permanent molar. After that age the development continues along diverging lines permitting the eruption of all of the permanent molars. Too much credit has been given, in the past, to the crowding forces of erupting teeth. This force is really developmental force and must not be expected to accomplish normal results when it, itself, is arrested or entirely suspended.

"The absence of growth spaces between temporary teeth is as surely and definitely an irregularity or deformity as would be the irregularity of the permanent teeth succeeding it."

Dr. McKay. Dr. Pullen's paper adds more evidence bearing on the difficulties of retention. Dr. Angle presented recently a paper bearing upon the tongue and lip habits in children, which will be taken as an epoch maker in orthodontia when the full significance of these habits is understood.

This matter is one of the things that certainly must be considered hereafter in the retention of a case. Up to the present time it has been scarcely noticed, and yet it must account for many failures, the causes of which have been obscure.

In listening to the subject as it was presented, many things that had puzzled me were made plain. It is almost discouraging to think of these things working against us in the dark, entirely involuntary on the part of the child—unnoticed by the parents, who often are loath to believe when shown, and who underestimate our fears in regard to them; and yet they are most potent forces, working steadily to undo our most careful and thorough treatment.

Dr. Lourie. I have been asked by several for an explanation of the lingual arch retainer, which has been referred to as having been suggested by me. At our Chicago meeting last year I presented the lingual arch as a basis for retention. We select certain teeth as a basis for diagnosis, and in moving the teeth we take the arch as a basis for moving appliances, usually. For the purpose of retention, after trying all the various methods with which I am familiar, I adopted the lingual arch as a basis.

The lingual arch first suggested itself to me in Class II cases, after jumping the occlusion, because the occlusal spur on the buccal side of the molar band had a tendency to tip the molar through increased leverage: also to rotate the molar. I joined the two molars with a lingual arch of irido-platinum. You can use whatever metal answers your purpose best, however. I used it because with a low carat of gold solder the stiffness of the metal was not materially altered.

The lingual arch re-enforces the molar retainers, in two ways: it prevents rotation, and tipping. Since this arch was used for re-enforcing those molars, I adopted the plan of retaining other teeth that had been moved, by attaching to this lingual arch. If a central incisor was rotated, I attached it to the lingual arch with a spur hooked over the arch in the way which would antagonize the return to its abnormal position. This attachment can be arranged so as not to prevent lengthening or shortening. I think it vitally important that a tooth should have the possibility of adjusting itself through the influence of occlusion, and I, therefore, avoid rigid attachment as much as possible. We must have some rigidity, however, at times.

If the molar has been rotated during treatment, and one wishes it to settle back to its original position or an improved position, you may transfer the attachment to a bicuspid tooth. Or, the lingual arch retainer can be used for further rotating the molar by adjusting the spring. I sometimes put it on for the purpose of rotating the molar, and at the same time use it as anchorage for moving other teeth.

It has been suggested that it is objectionable to attach directly to the screw of the clamp band. There are some objections to that, and when you find it objectionable the band can be reversed and the lingual arch attached to the opposite end of the screw. Many times you will want to reverse the clamp band anyway, and allow the screw portion to extend back beyond the second molars to keep the second molars expanded.

The lingual arch which is to be attached to the clamp or plain bands, should be made very accurately, and if not sufficiently skilled to solder them properly, you may put them on a plaster model made for the purpose.

In the case suggested by Dr. Rogers, if the incisors have been lengthened or depressed in their sockets they might cause sufficient strain on the lingual arch to tip the molar, because you have the retractive force of the incisors exerted on the molars, with a long lever: so re-enforce with some attachment to the bicuspid or cuspids: use a hook over the arch attached to the tooth, for instance.

Dr. E. A. Bogue.

I feel thankful to Dr. Lourie for the ideas he has promulgated. I also wish to make due acknowledgments for one other feature of this meeting, which is that each speaker seems to feel himself absolutely free to criticize the essayist as his production is under discussion; so that when Dr. Pullen showed us what he did, it was with great delight I heard the questions asked and his answers. I want to offer him my compliments for showing us what he acknowledges was, at least, a partial failure. It is not every fellow that has the courage to do that.

Dr. Pullen left two or three things to be asked, I think. Why does he not, in the cases he shows, push all his teeth out to their proper places in the arches?

I would also like to ask Dr. Pullen why he retains teeth in positions he does not want them to occupy? I refer to the case in which he said the fixtures made it look as though the laterals were too far lingually.

Dr. Hawley, in showing us how to plot a dental arch from the measurement of one, two, or three teeth, has but adapted himself to the conditions of nature, and when he and Dr. Young agree that the temporary molar teeth are just the size of the permanent ones which are to replace them—I have no doubt they are correct. At the same time I should feel like doing what Dr. Rogers said we must do: "we must take our patients before the temporary teeth are all lost." I think he is quite correct: but how are we to get them? Every now and then a sixteen to twenty year old patient comes along, and inquires, "Am I too late?" Dr. Ainsworth says he has done something for patients up to the age of 48 or 49 years, and now I believe Dr. Baker speaks of a case wherein the patient was 62! It is of the greatest importance, as I see it, that we should undertake these cases long before the permanent teeth are in place, so that the attachment or adjustment of fixtures may be attended to without danger of injury to the permanent teeth. I prefer the use of bands, ligatures, etc., upon the deciduous teeth to their application to the permanent ones.

I can not see why Dr. Hawley's plan will not admit of sufficient enlargement of the temporary row too, because the same force which operates *in utero* for the formation of the upper jaw, will operate afterward to reduce the jaw if it is too large.

Dr. J. Smith Dodge asked many years ago how long should a tooth which has been moved from malposition, be retained? Dr. Ottolengui undertook to answer that question, but he was jesting. I hoped he might say that the teeth should be kept there until the entire occlusion was restored. In fact the worst teeth to get out of order are the six lower front teeth: if these are kept right and proper articulation is had with reference to the others, bicuspids and molars, they will stay.

Dr. Pullen. I have been much pleased with this discussion, because it has brought up so many valuable points in our every-day practice. Retention is one of our most difficult fields, and we have much to learn, and it will take years to discover all there is to know about it.

I must agree with those who have spoken of over-expansion of the arches. It is our common procedure to move the teeth further than we want them. Another thing, we must give Nature a chance for development, in our retention. In many instances we are not through with our cases at retention: not for years afterward, although we may receive our fee when the retaining appliance is put on.

One case Dr. Bogue mentioned, if you will remember, where the upper lateral incisors were in lingual occlusion and were moved into position. I moved those teeth out. The retention afterward was simply to hold through a developmental stage. That particular case needs more work done on it after a certain period of development. I have held it now eight months. It is not a finished case, but there has been development, and it is one of the most interesting cases I have ever undertaken. The watching during that period of that development of the process and anterior part of the arch, has been most interesting. Another thing Dr. Bogue mentioned, to which I referred: How long should the teeth be retained? The occlusion is important always, as we all know. I would limit the influence that occlusion would have in those cases, to simple cases and to special cases, because we do not believe that in extreme cases the occlusion would ever hold them unless they are first retained a very long time. If retained until the inclined planes are in correct position, you might succeed.

I would like to compliment Dr. Lourie on the points he brought out in connection with the lingual arch. With its use I have enjoyed the retention of Class II and III cases better than ever before. The points he brought out this morning are just the ones we need in our every-day work: to know how to overcome the difficulties that are coming up all the time in connection with the lingual arch.

I was pleased to have Dr. Hawley, who has spent much time and study on measurements of the normal arch, bring out the points he did as to the space occupied by the deciduous cuspids and molars being sufficient for the permanent teeth.

Prophylaxis as Related to Orthodontia.

By Dr. H. C. Ferris.

This theme, while old, seems to have been overlooked in the rapid development of this specialty, or else writers have considered that men sufficiently intelligent to undertake its practice, would use ordinary precautions. However, I make bold to present this subject for your consideration.

Our field of operation is one of low vitality, owing to perverted nature, caused by nasal obstruction in a large percentage of the cases, making mouth breathing a necessity; producing an abnormal development of the mucous tissue of the oral cavity, and air passages. The antiseptic qualities of the nasal mucoid secretions having been lost, the air passes through the mouth and the lungs are laden with bacteria owing to this abnormal action. The hypertrophy of the faucial and pharyngeal tonsils, render them more susceptible to the attacks of all the animal and vegetable bacteria that are found in nature.

The physical condition of these patients due to this abnormal functioning, renders their system less able to resist attacks of bacteria, such as the diplococcus of pneumonia, bacillus of diphtheria, etc.

The accumulation of carbohydrates and proteid substances after each meal, form the best food for nourishment of oral bacteria by clinging to the metallic appliances both stationary and removable, and are with difficulty removed with most careful mechanical means. In most mouths the characteristic fermentation occurs after each meal without such appliances; therefore, with them and their accumulating tendencies, this action is proportionately increased. The formation of carbohydrates is accompanied by the production of certain acids of which lactic acid is the chief.

The decomposition of albuminoids results in alkaline reaction. When two are mixed they produce a mild acid reaction, depending to a degree on a particular form of bacteria acting upon the mass, and partly to the nature of the food and the percentage of the carbohydrates in it. According to the percentage of excess of lactic acid formed during the fermentative action of certain oral bacteria on the carbohydrates in the mouth, we find the pathological conditions of the mucous surfaces increased, as a hyper-acid condition of the oral secretions proves to be one of the irritating causes of disease of these tissues, lowering their functioning ability and thereby rendering them more vulnerable to any form of micro-organisms.

Can we afford in our effort to assist nature to establish a normal occlusion, to neglect our hygienic precautions during this process, by placing materials in the oral cavity which increase the surface for accumulation and culture of these organisms, without endeavoring, with the means we have at hand, to reduce the quantity of their reproduction? By bacteriological experiments we learn of the rapid growth of these organisms in the oral cavity, and we find by clinical experience, that the teeth and appliances are rapidly covered with oleaginous substances which become a favorable medium for their culture.

The antiseptic qualities of the copper used in some of these, we appreciate, but we know that colloidal copper which produces this antiseptic action is only given off while the metal is polished and free from albuminoid deposits. So when wires containing this metal are not submerged under the gum tissue, this antiseptic action is soon lost; therefore, we must look to other means for cleansing these surfaces.

Again in the adjustment of wire ligatures, even in the most skilful hands, the operator is apt to puncture the mucous tissue, and as these wires presented to us by the trade are found to be bacteriologically unclean, we are liable to infect this susceptible subject.

We have a few cases on record, one of which was reported to the Second District Dental Society of the State of New York, of tuberculosis in its most virulent form, from the use of a septic dental scaler, which resulted in the death of the patient. The difficulty of tracing these infections to the hands of the dentist, is the reason for fewer reports of this character. Simple methods in technique can in a large extent control such infections.

If on the contrary, we find that the wires furnished us by the dental supply houses are sterile, they are liable to be infected by handling. The composition put on the market by Dr. E. H. Angle, will frequently give negative bacteriological results, as tube No. 1 will prove. (Demonstrating.)

This bouillon tube was infected by a wire of this make and kept in an incubator in Seney Hospital laboratory under the care of Dr. Dexter, pathologist, and was accompanied by tube No. 2, which contained some of the same bouillon, which was infected with serum from a septic wound, and was introduced into the incubator at the same time as tube No. 1, and developed the culture you see in half the time. This single experiment does not prove these wires all sterile when they reach our hands, and the method of sterilization is so simple that we should run no risk.

Sterilization of Ligature Wires.

By introducing a bundle of wires into a U shaped glass tube, we may sterilize the contents, either by boiling in a saturated solution of sodium carbonate for twenty minutes, introducing a small cork, and allowing them to remain in the solution; or by exposing them to the action of formalin gas for eight hours; or by allowing them to remain in a colloidal copper solution for one hour; or by sterilizing with dry heat. By any of these methods, we may be reasonably sure we have a sterile product. Each method has its advantages and disadvantages. The preference would be given to that of boiling, as it does not require repetition, the solution protecting the wires from oxidation and from re-infection from the air and hands.

Mouth Sterilization.

Our field of operation is the most septic of any cavity in the body, therefore the first step in the technique should be to render the field aseptic.

We first mechanically cleanse the teeth with frictional material, as thoroughly as possible, then spray the parts with antiseptic solutions under high pressure, which will destroy the bacteria present. We have numerous antiseptic agents of varying value, from which we may select one sufficiently powerful to meet the case. The most cleanly patients, naturally present the most healthy tissues; but their susceptibility to infection, owing to the general condition, must be taken into consideration.

To prove this necessity, a wire that had been worn three weeks without prophylactic care was taken from a mouth. It was gently scraped with a sterile platinum loop by the pathologist; the wire was placed in one bouillon tube and the scrapings in another. The former developed no culture, evidently proving the antiseptic qualities of the composition, as the surface was enabled to give off colloidal copper. The latter was used to infect another tube which produced a culture. A microscopical slide developed the presence of bacilli, diplococci, and micrococci.

There are solutions that are largely alkaline with little antiseptic value; but the patient's sense of taste must not be considered to their detriment. The solutions which are sufficiently strong in antiseptic value, are not particularly pleasant; but if our efforts be sincere, they must be thorough. There are two drugs which are accepted by our authorities, which we may employ. The first may be used in mild conditions, and consists of:

℞	Trikresol	m. xxx
	Oil of Cassia	m. xx
	Aq. dis. ad. q. s.	oz. iv

M. Sig. To be used in spray at a temperature of 105 degrees F.

The active principal of this solution is the trikresol, the oil of cassia being used to disguise the disagreeable taste. The former is a clear watery liquid, having three times the disinfecting value of carbolic acid, while it is three times less poisonous, and less caustic; and is composed of ortho-cresol 35 per cent., metro-cresol 40 per cent., and para-cresol 25 per cent. In bacteriological experiments undertaken by Major Walter Reed, Curator of the Army Medical Museum in Washington, he found that a 1 per cent. solution of it accomplished as much as a 4 per cent. or 5 per cent. solution of carbolic acid. It is particularly valuable for our purpose, as it is active in fluids rich in albumen; being neutral in reaction it leaves the metallic surfaces bright. It is also readily soluble in aqueous solutions.

In acute conditions, when we require a stronger antiseptic, we may use a solution composed of:

℞	Iodine	m. xix
	Potassium Iodide	m. xix
	Aq. dist. ad. q. s.	oz. iv

M. Sig. To be used in spray under high pressure at a temperature of 98 degrees F.

The antiseptic value of iodine has been recognized for centuries. This agent in its powdered form, iodoform and aristol, is a standard in our hospitals. It possesses a quality which produces the destruction of a capsule of the spores that bichloride of mercury does not possess. It has been recently found that the solution of this drug becomes more potent when potassium is combined with it, increasing its solubility. The American Pharmacopoeia, of 1906, directs the addition of potassium to all tinctures of this drug. The solution here recommended, when sprayed in the oral cavity, will fix the plaques of bacteria so they may be detected upon the surfaces of the teeth as well as on the appliances. In order to remove these plaques a mixture of

℞	Starch	dr. iii gr. ii
	Aq. dist. ad. q. s.	oz. iv

will convert the iodine into an iodide of starch; which is more readily washed off the surfaces with a solution of:

℞	Sodium Carbonate	gr. xviii
	Oil of Gaultheria	m. xxx
	Aq. dist. ad. q. s.	oz. iv

M. Sig. To be used in temperature of 115 degrees F.

This last solution also tends to free the surfaces of oleaginous matter.

After this treatment we can be reasonably sure that we are working on sterile tissue, and the liability of infecting our patients is reduced to a minimum.

Sterilization of Hands and Instruments.

The necessity for sterilizing our hands, using a sterile brush with green soap, and immersing them in an antiseptic solution, preferably 3 per cent. camphenol, which should stand in a bowl within reach of the operator for freeing his hands of mucus during his work; the boiling of pliers, scissors, mouth-mirrors and carriers, between patients, are precautions that no intelligent operator can neglect. Instruments such as lances, scalpels, etc., may be boiled for twenty minutes in glass tubes in a saturated solution of carbonate of soda, and placed in the cabinet ready for use at any time.

The prophylactic treatment at each visit, once a week, requires but fifteen minutes, and the results are remarkably satisfactory. The patient is directed to be particularly careful in cleansing the mouth, and is given a solution as follows:

℞	Hydronapthol	
	Menthol	aa gr. xxx
	Oil of Gaultheria	
	Oil of Cassia	aa m. iv
	Sp. Vin. Rect	oz. x
	Tinct. Capsicum	dr. x
	Aq. dist. ad. q. s.	oz. xx

M. Sig. Teaspoonful to half-glass hot water.

to be used twice daily, morning and night, and in acute conditions, five times daily, holding the same in the mouth for three minutes. A mouth thus cared for, will show little, if any, inflammation even in the presence of irritation, and the operator may feel that he has done all in his power to protect his patient. Tube No. 6, is a bouillon solution in which is a ligature wire which had been worn in the mouth for one week under this prophylactic treatment. It was gently scraped with a sterile platinum loop by the pathologist, the wire being placed in one bouillon tube and the scrapings in another, and at the end of three days developed a negative result.

I am indebted to the following gentlemen for many of the scientific facts used in the presentation of this subject: Dr. T. H. Dexter, Dr. G. E. Hunt, Dr. T. W. Brophy, Dr. A. W. Harlan.

Afternoon Session.

Dr. Casto, Chairman.

Discussion.

Dr. O. W. White, Detroit.

I have listened with great pleasure to the paper which Dr. Ferris has presented to us this afternoon. I congratulate Dr. Ferris on the able manner in which he has introduced this subject to the society. It is the first time oral prophylaxis has been presented to us, and I hope it will not be the last.

Dr. Ferris has left one important branch of oral prophylaxis out of his paper; viz.: the mechanical treatment. While the orthodontist is handicapped to a large extent by the appliances in the mouth during treatment, still we should carry out this part of oral prophylaxis as much as possible, for the benefit derived can not but be a great aid to our patients in maintaining a healthy condition of the oral cavity.

When a patient presents himself for treatment for malocclusion, we should be just as insistent about the general health of the mouth as we are of the teeth. I find that if a patient starts out with a clean mouth, and we maintain it in that condition, we have no fear of embarrassment from injury to the teeth during treatment.

I would like to have Dr. Ferris tell us his success in preventing decay when errosion has already taken place on the enamel.

I have observed some work of Dr. Grace Rogers, of Detroit, and she has prevented decay where errosion has occurred. A few years ago this was considered impossible.

The formulae which Dr. Ferris has given us to be used as sprays seem to me to be ideal if they do not affect the appliances.

We must educate our patients in this line of work, and our instructions should be carried out fully by the patient if we wish to be successful. I wish to show a little brush which has been a great aid to me with my young patients. It is called the "Rolling Tooth Brush," and with it a patient can reach all the surfaces when appliances are in position.

Dr. Morris T. Schamberg, New York.

I was very much pleased to be present when Dr. Ferris was reading his paper bearing upon the value of asepsis and antisepsis about the mouth during the introduction of orthopedic measures. No doubt the soft tissues are frequently impinged upon in the adjustment of regulating appliances, and whenever such is the case, there is always a possibility of infection.

I am much pleased with the character of work the doctor has been conducting in testing the true merits of various mouth washes, and the best means of keeping instruments in an aseptic condition ready for use. The latter is a problem not easily overcome in the dental office, and I feel confident the adoption of the test tube method of having the ligatures remain sterile until used will be a helpful one for the orthodontist as well as the general practitioner of dentistry.

Dr. Ottolengui.

It has been said that dentists pay but little attention to this part of their work, and I think some of you gentlemen ought to reply to this accusation, or slur.

Dr. Varney E. Barnes.

Dr. Ottolengui says we ought to answer the slur cast on orthodontists as regards prophylaxis. I am not sure but that a great deal of it has been merited. In visiting many orthodontists and dentists I have found them working on many patients, one succeeding another, and found many had but one or two instruments of a kind, such as pliers, scissors, etc. When asked how they sterilized them, I found they simply wiped them off with towel or napkin. They did not sterilize. I think the paper very timely indeed. The metal spray which the doctor recommends is the only one which can always be sterilized. The hard rubber sprays are practically useless.

I would criticise Dr. Ferris's statement, "that we deal with patients of low vitality, due to adenoids, enlarged tonsils," etc. I would say, however, that these are the results of this lowered vitality, all the results of a common cause. They aggravate the irregularity, but are not the chief cause of it.

The paper should do good as it goes out in the dental prints. I hope it will make us all more careful. Another point as to mouth washes. The doctor says we can not have a pleasant spray and have it efficient. I have had much difficulty in getting patients to use an unpleasant one. They simply refuse. I would ask the doctor to turn his attention to the production of a wash that the patient will use.

Dr. Abell. Regarding the care of ligatures. In hunting for glass tubes in which to keep them, I went to a surgical supply house, where I found a catheter case with a screw cap. I sterilize the wires and place them in this. You can pick out one wire at a time as it is needed, leaving the rest in a sanitary condition.

Dr. Milton Watson. I thoroughly appreciate the paper, and also the fact that it deals with a subject which has not received sufficient attention. I think there has been a tendency to be a little careless along this particular line, and, while it is true that most of our work is of such a nature that we do not come into contact with actual wounds, and as a result the probability of infection is of course greatly lessened, yet that really does not justify the carelessness which is more or less common.

The difficulty in attempting to follow out the plan outlined by Dr. Ferris is, if I understand him correctly, that it would require ten or fifteen minutes for each patient, and that becomes a more or less serious matter unless possibly our assistants could be trained to do the work. With a faithful, conscientious assistant, I see no reason why this work could not be performed, and still be well done, without infringing upon the time of a busy man.

Dr. Visick. I think the paper most excellent and useful to us. I would like to ask the doctor what he thinks about the use of cement in adjusting clamp bands? Some of us have been taught that the use of cement under such circumstances is unnecessary, unless the case is to require some time in its correction. I believe it to be absolutely wrong not to use cement, and that such a course is injurious to the teeth.

Dr. E. A. Bogue. Some of my professional brethren have referred patients to me; in one instance I found every tooth surrounded with a band, and there was no cement anywhere. This was inviting decay. A clean tooth never decays. Antiseptic surgery is clean surgery. There is such a thing as a finnicky condition about some things and entire carelessness about others. I am glad Dr. Visick has referred to this matter of cement under bands. I know there has been a course of instruction in which the use of cement was not deemed necessary in placing these bands.

I have on my operating table, within reach of my hand, five teeth taken from among one hundred, which one hundred teeth were covered with melted beeswax and then some portion of the enamel exposed to an extent equaling about one-eighth of an inch in diameter. Those one hundred teeth had been placed in saliva containing a little bread, and kept at blood heat for ninety days. In ninety days every one of those one hundred teeth showed decay. The object of the experiment was to learn whether the density of teeth has anything to do with the progress made by decay. If that can take place, imagine what could take place under uncemented bands!

We should be much more careful in the directions given to parents with reference to care of the mouths of the children, and this, with our own efforts, should keep them, if not absolutely aseptic, at least as nearly clean as possible under the circumstances.

Dr. Strang. I think one point in the paper covers a great deal; i. e., lack of resistance. We know we are dealing with cases where there is a great lack of resistance, and every precaution should be taken. We are dealing with cases where there is very often hypertrophy of lymphoid tissue. We were told yesterday how rapidly bacteria multiply in that tissue. The bacteria are there ready to attack when we are applying ligatures and wounding the gum. We should be careful to see that those places are kept free from these bacteria, and the most effective way is the use of a spray, under pressure. Remember, further, there is a direct connection of the blood supply and peridental membrane. Following the wounding of the gum, an infection may be carried to the peridental membrane, which means pain. We must relieve as much pain in our work as possible. We can help do this by keeping a sterile field.

In the matter of boiling sharp instruments, I think the edges will be left in better shape if carbolic acid, etc., be used instead of boiling.

Dr. H. C. Ferris. In answer to Dr. White's remarks with reference to the acid erosion, it is a general subject which has been pretty well covered before. If there is any truth that the colloidal copper given off from these copper bands is antiseptic, which my experiments have proven, then we can explain why a band may remain on a tooth for a limited period without producing any erosion provided it has been fitted properly. The products of decomposition will not take place in the presence of an antiseptic; therefore you would not have acid present; consequently you would not have the same result under the hand where the colloidal copper is given off. If the bands are made of gold or platinum, I believe the action of erosion would be increased, because you have no antiseptic action. The colloidal copper solution has been proven to be antiseptic beyond a doubt. It can be tested by placing all kinds of bacteria in a polished bowl of copper. In an hour's time the solution will become sterile. This subject has been covered in a previous paper by Dr. Harlan.

The above remarks reply to Dr. Visick as well as Dr. White.

One of the gentlemen spoke of the enlarged tonsils. I simply touched upon that in this way: we invariably have an abnormal condition of the mucous membrane and the tonsils (at least in a large percentage of the cases). If we add something to the part which increases the tendency to the formation of acids, by allowing the accumulation of foods and their decomposition, we increase the irritation of those already irritated tonsils because of the presence of the acids, but that acid condition does not necessarily produce an infection, but lowers the vitality of the tissue, rendering them susceptible to infection.

As to Dr. Watson's remarks, I think his method is excellent. Fifteen minutes does not seem much time, but in seeing many patients it amounts to hours, and while we can not neglect this care we can engage assistants to do this work for us. With this system of sprays that I have introduced here it is not a matter of theory, but of actual observation. Your iodine turns the bacterial plaques on the teeth brown. I can dissolve the plaques away with another spray. Any good office attendant can do that work for you, but you must allow four or five minutes for each chemical reaction.

In replying to Dr. Bogue, I may say the experiments he has carried out with the teeth seem to be a little unscientific. A solution of saliva introduced into an incubator will contain a certain percentage of bacteria. Any bacteria will multiply many times in a couple of hours. If you take saliva and introduce it into an incubator where the conditions are favorable, the bacteria will multiply until its toxin is formed. An abnormal quantity of acid would be formed, owing to the growth of the bacteria. Therefore, in order to carry out experiments as the doctor has suggested, you have actually to keep track of the number of bacteria which you had in your solution: you would have to introduce a certain number of them into a certain quantity of saliva, and keep track of them in that way. I think that would be a hard method.

Dr. Strang mentioned the use of carbolic acid. That is a consideration that is not vital. Some instruments, if very delicate, are affected by boiling, partly from the action of chlorine in the solution; carbonate of soda counteracts the acidity. The action of carbolic acid, in dilute form, will also affect the instruments. A razor immersed in a dilute acid solution will be affected at its edge. If the solution is alkaline, the result will be very much better.

Any method used to sterilize your instruments is a step in the right direction, I am sure.

Use and Application of Inter-maxillary Force.

By Dr. Norman G. Reoch, Boston, Mass.

It often happens in original research, that scientific minds, working entirely independently of each other, may simultaneously startle the world with some great discovery. Inventors in devising improved methods to secure greater economy, or efficiency in the industrial arts, frequently arrive at the same conclusions. No doubt various instances of this kind may occur to you.

In 1893, at the International Dental Congress of the Columbian Exposition, Dr. Calvin S. Chase read a paper, in which he first brought to light the use of inter-maxillary force. Shortly after this period, Dr. H. A. Baker, of Boston, without knowledge of Dr. Case's discovery, commenced the correction of a case of distal occlusion in his son, employing the elastic force.

As to who deserves the credit of first using and publishing the use of inter-maxillary force, I do not think there can be a question in our minds. That honor belongs to Dr. Case, of Chicago. It does not detract from Dr. Baker's credit, however, that he did not publish quite as early his experiments with this great power. To both men great honor is due. There seems to have been an era of awakening in both men's minds of the possibilities in the use of the power derived from the stretched elastic band.

Much more important to us, however, than the question of to whom honor is due, is the fact that this most indispensable adjunct to our appliances was given to us at all. As the possibilities in employing it in combination with other forces, and as an auxiliary force, began to dawn upon the minds of men practicing orthodontia, then it was that the extractionists received their death blow. It seems unfortunate that some of the followers of Dr. Case have not more fully developed and worked out in a practicable way the possibilities of his discovery, and abandoned the method of extraction, which savors too much of a bygone age, where heroic methods were commonly practiced. To my mind, extraction should be confined to the same category as blood-letting and other practices of the old school. This statement applies to the great majority of the cases we are called upon to treat. There are cases doubtless where it may be absolutely necessary to extract, but they are exceedingly rare. At least, I have not yet come in contact with such cases personally.

Inter-maxillary Force Defined.

Inter-maxillary force is a force working between maxilla and mandible. In the treatment of all those cases where harmony in the relationship of facial lines, jaws and teeth, is only possible by shifting the occlusion—the force now universally adopted is the pulling force of the rubber ligature. There are other forces which might well come under the heading of this paper, such as the bite-plate, inclined plane, etc. I will speak of these briefly later. But the force by far the most important, because of its reciprocating energy, the innumerable combinations possible in applying it, and because of the constancy with which it works—is the force derived from the simple elastic band.

Its simplest use may be best illustrated by employing it in the elongation, or in the forced eruption of a tooth in the upper jaw, the other end of the elastic being held by appliances upon teeth of the lower arch. You are all perfectly familiar with the example. This use of inter-maxillary force was first given to us by Dr. E. H. Angle, in 1891. In its employment there is no tendency nor intention of affecting the mesio-distal relationship of the inclined planes of the opposing arches.

In Class I cases, the rubber ligature is a valuable auxiliary to the expansion arch.

[A picture was shown in which space is being made for the upper left first bicuspid, by forcing the cuspid and incisors labially by ligating them to the arch in front of spurs upon the expansion arch. This distal displacement of the upper molar in overcoming the resistance of the moving teeth is prevented by the elastic force, shown by the dotted lines working in the opposite direction.]

Figure 1.

This picture also illustrates beautifully the reciprocating action of the elastic. This case is identical with the first diagramatic sketch, except that in this instance it is the lower molars that are prevented from displacement by the pull of the elastics. Spaces for the full eruption of the lower second bicuspids are not enough. This condition, associated with an abnormal fraenum labium, gives to the models, and more perhaps to the face, the appearance found in Class II, Division I cases. In the mesial movement of the lower teeth anterior to the second bicuspids, all the resistance falls upon the molars. To conserve this primary anchorage, the elastic force is invaluable. The pressure upon the molars through the nuts on the arch is overcome largely by the pull of the rubber ligatures around the distal ends of the tubes. By careful manipulation of nuts, and a knowledge of the strength of pull of the elastics, it will be apparent that the stress upon the molars can be kept at zero.

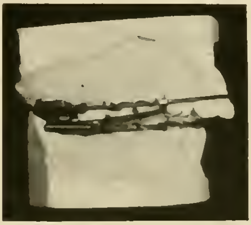


FIG. 1.

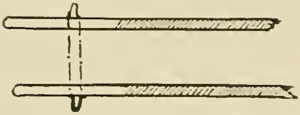


FIG. 2.

At the other end of the inter-maxillary force the pull is effecting pressure upon the prominent central incisors. The pressure at this point is regulated by the nuts in front of the tubes on the upper clamp-bands.

Figure 2.

In cases where there is a lack of anterior occlusion there are several methods of overcoming the difficulty. One is by banding individual teeth, upper and lower, and stretching elastics between them over spurs on the bands. Another method I have found most serviceable is one illustrated in Fig. 2. It is a means of overcoming the difficulties of such cases which Dr. H. A. Baker has used with unqualified success. The springs of the arches are used in conjunction with elastics stretched from maxilla to mandible over spurs soft-soldered to the arches, upper and lower, at the desired joints. The arches are bent to the required shape, and with the proper amount of spring, then held up to place and ligated firmly to the teeth requiring elongation. The elastic pressure is applied as an auxiliary to the spring of the arches. Dr. Baker uses heavy pieces of separating elastic cut in squares and with holes punched in them; these he has his patients snap over the spurs, from arch to arch, at night.

Figure 3.

Occasionally I have had cases referred to me that have been carried on—up to a certain point—by some one else. I have found in several instances molar teeth carried by an excessive spring in the arch, far out into buccal occlusion, sometimes beyond the danger line, *e. g.*, the lingual cusps of upper molars, buccal to the buccal cusps of the lower corresponding teeth. This drawing will serve to illustrate the point. If it is the upper molar that is in buccal occlusion (as here represented), I solder to the upper edge of the tube on the upper clamp-band a little spur. An elastic ligature attached to this spur, and passing between the occlusal surfaces of the upper and lower molars, is hooked over the extension in front of the nut on the lower clamp-band. This simple way of applying inter-maxillary force I have found most serviceable. It perhaps is never necessary for any one of the gentlemen present to re-

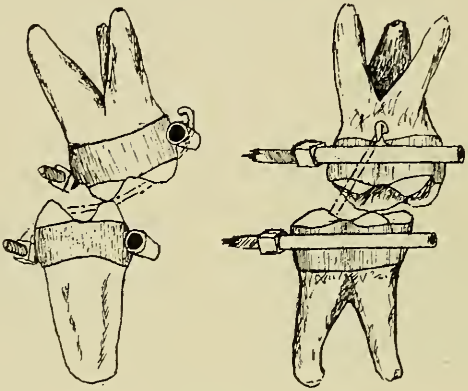


FIG. 3.

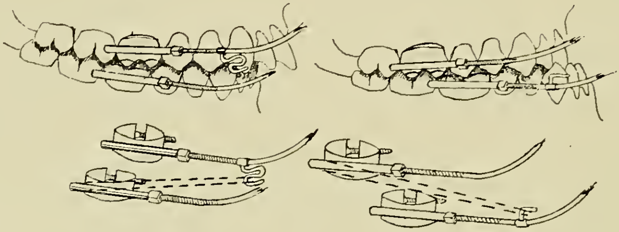
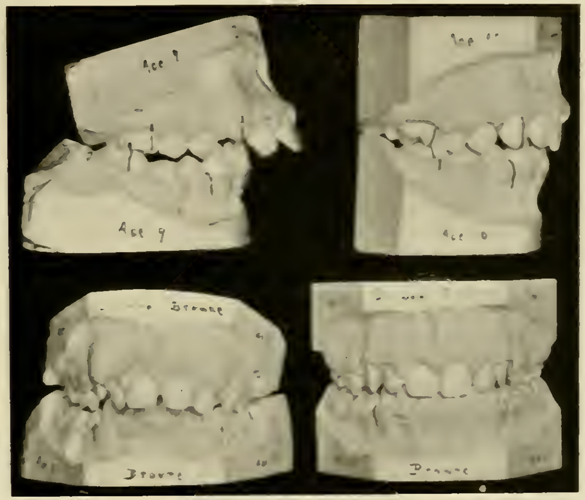


FIG. 4.

sort to such treatment in quickly aligning buccally displaced molars, upper or lower. But unfortunately I have had to cope with this difficulty on several occasions in treating cases coming to me from inexperienced hands.

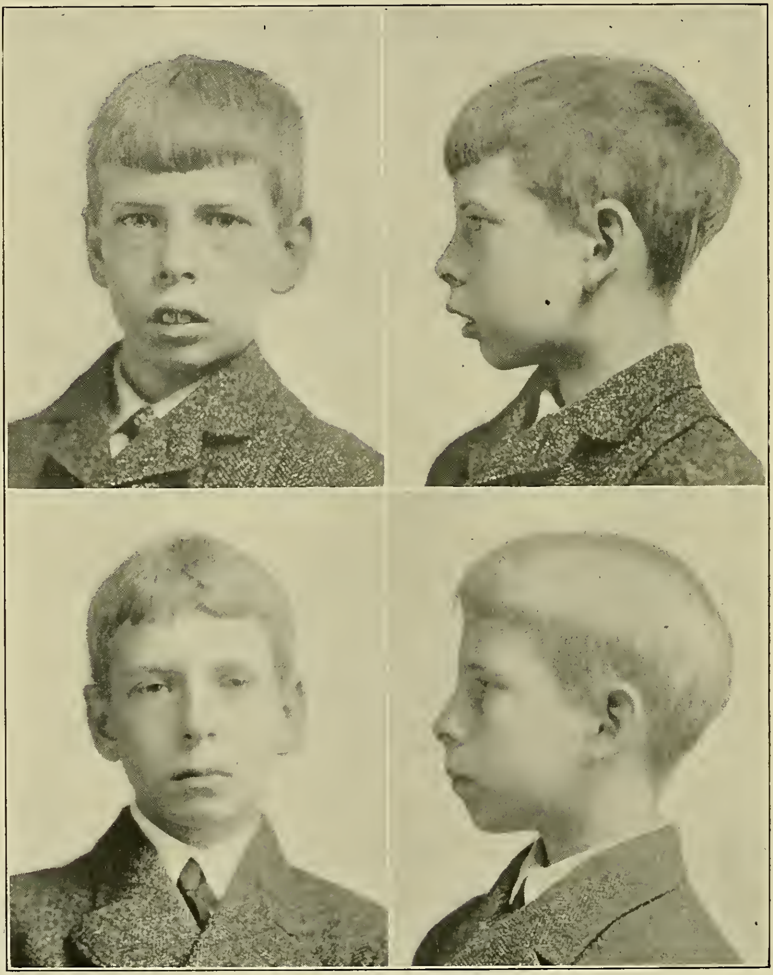
Figure 4. This is a diagramatic sketch showing the application of inter-maxillary force for cases of distal occlusion and mesial occlusion.

Figure 5. The picture in this figure shows the side views of a case of Class II, Division I. This is an extreme case of its class, with lower incisors impinging upon gum-tissue back of the central incisors. When the boy came to me he was wearing caps upon the lower molars to relieve this condition. These caps were in place when the impressions were taken for the models before you. Both arches were expanded laterally, and when the inter-maxillary elastics were applied, force was at first exerted only upon the upper central incisors. The amount of pressure at this point was governed by the releasing or tightening of the nuts in front of the tubes on the upper clamp-bands. The lower incisors were carried labially by the usual method, the elastic attached around the distal ends of the tubes on the lower clamp-bands acting as auxiliary anchorage to these teeth. When the lower arch was expanded sufficiently, all the



Figs. 5 and 6.

teeth were ligated firmly to the expansion arch, and pitted *en phalanx* against the upper incisors. In this case I desired as little distal displacement of upper molars as possible, so the nuts on the upper arch were released somewhat during treatment.



Figs. 7 and 8.

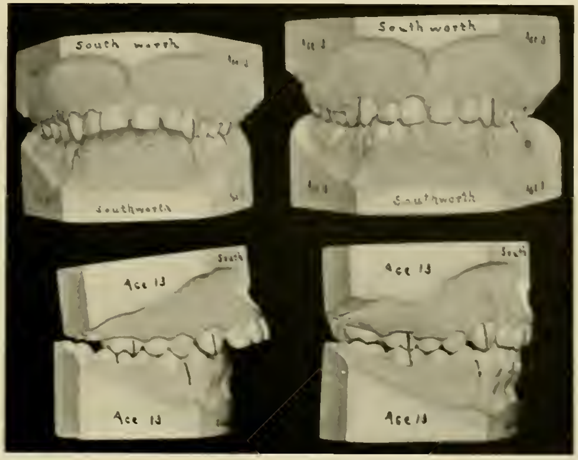
Figure 6. Front before and after. If there was any depression of the upper incisors, or of the lower incisors in their sockets (and I believe there was), it was accomplished by the spring of the arches caught in notched bands

upon these teeth. At the present time, a year since the final models were made, the bicuspids and cuspids have fully erupted, so that the interlocking of cusps is even better than here shown.

Figure 7. Face before. Front and side.

Figure 8. Face after. Front and side.

Figure 9. Front models, before and after. This case is also of Class II, Division I. It is of particular interest to me because it is the first case of an extensive malocclusion that I have treated by only weekly appointment.



FIGS. 9 AND 10.

Figure 10. Side models, before and after.

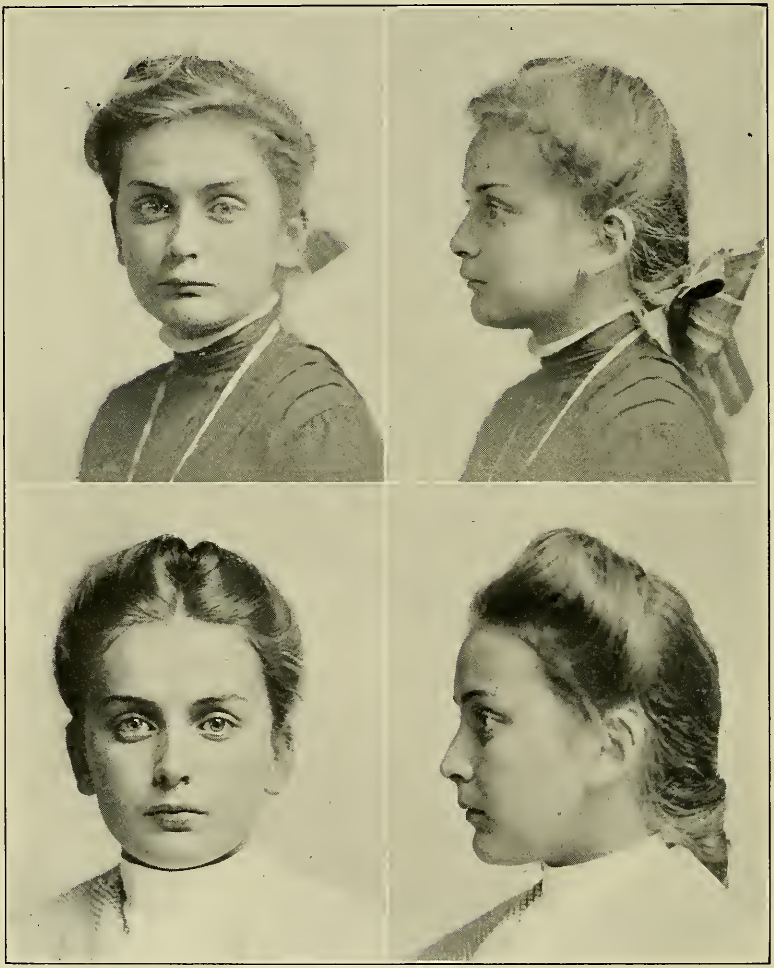
Figure 11. Face before treatment. Front and side.

Figure 12. Face after treatment. Front and side.

The next three plates were loaned me by Dr. Casto, of Cleveland.

Figure 13. This picture shows the kind of cases in which Dr. Casto employs a bite-plate with individual bands and elastics for final steps in treatment. The picture before you now is of Class II, Division I. Incisors impinging upon soft tissues behind upper incisors. Molars and bicuspids are short, and the upper and lower incisors are too long. Dr. Casto first expands the arch as usual in the treatment of these cases, and retracts by inter-maxillary force and the spring of the arch the prominent upper incisors. The case is then ready for the bite-plate and individual bands.

Figure 14. This picture shows a bite-plate—a modification of Dr. Kingsley's bite-plate—designed by Dr. E. H. Angle. Dr. Casto applies such a plate to the upper arch. This plate holds the expansion of the upper arch. Wires are fitted over edges of the upper incisors and vulcanized in the plate. This prevents them from moving labially, depresses them in their sockets, and also prevents the plate from striking too hard upon the soft tissues.



Figs. 11 and 12.

In the lower portion of the figure is seen the way in which Dr.

Casto applies inter-maxillary force between individual teeth from maxilla to mandible, where it is desired to get a better interdigitation of cusps, and a shifting of occlusion, as in this case. The desired teeth are banded, with spurs soldered to their buccal surfaces to engage elastics. This elastic pull tends to straighten the roots to a greater or less degree, thus correcting the buccal slant of the cusps.

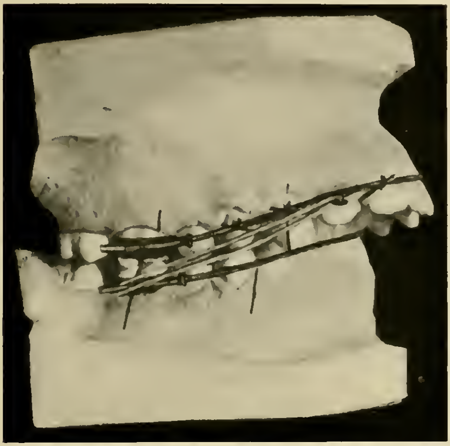


FIG. 13.

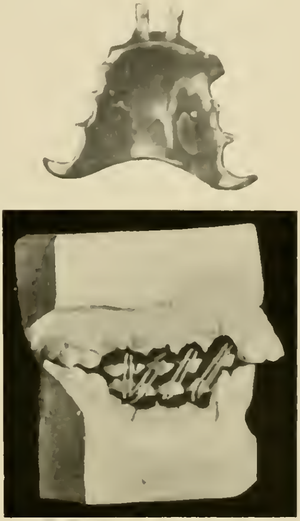


FIG. 14.

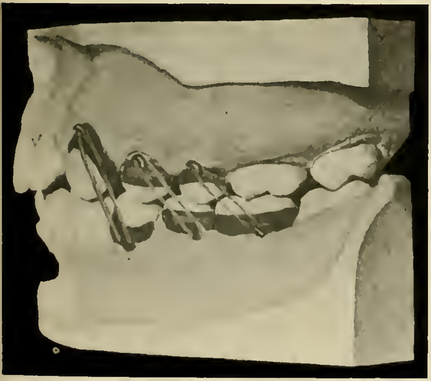


FIG. 15.

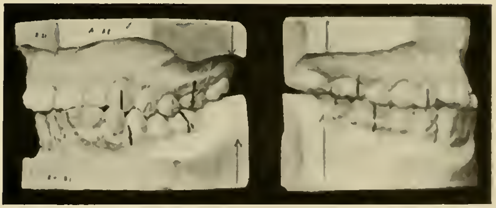


FIG. 16.

Figure 15. This slide shows the case as it is nearing completion. The desired settling of the occlusion is about finished. The bite-plate has depressed the incisors, upper and lower.

The lower arch is kept forward partly by the strike upon the inclined plane of the bite-plate, and partly by the pull of the inter-maxillary elastics. The lower incisors are depressed while bicuspids and molars are being elongated by the elastics.

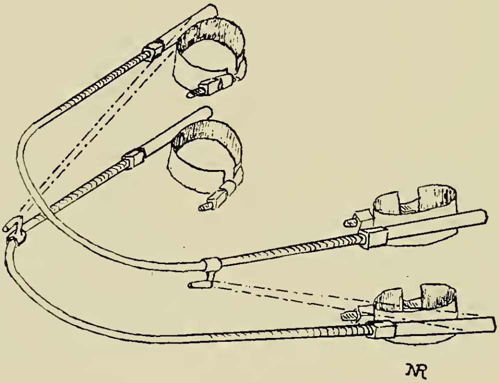


Fig. 17.

The next three plates were loaned to me by Dr. George C. Ainsworth, of Boston. They show very clearly his method of applying the inclined plane in just such cases as Dr. Casto uses his bite-plate. The idea, of course, is the same, but the manner of attachment differs. The plane is soldered to the lingual surface bands upon the upper central incisors. Wires are bent over the incisal edges of the laterals; this is again re-enforced by wires passing distally to the molar bands. The expansion is also held by the wires. In the pictures shown the molar bands are the same bands used in the expansion of the arch before the plane was adjusted, the tubes are unnecessary.

Dr. Ainsworth first expands upper and lower arches to the extent desired, and then applies the inclined plane to depress the upper and lower incisors, and allow molars and bicuspids to settle to occlusion. The inclined plane may be so adjusted as to correct cases of this kind where there is unilateral distal occlusion. I have one case where I have accomplished this movement.

If you could see some of the beautiful results which Dr. Ainsworth has accomplished with this little inclined plane you would be delighted.

It is a most valuable adjunct in combination with our retainers in cases of Class II, Division I.

In the fall of 1904 Dr. R. B. Stanley, of New York City, referred to me the case of a young lady who was to spend the winter in Boston. He had expanded the arches considerably. She came to me with the upper appliance adjusted, and with a stay-plate in the lower arch. I continued the expansion upon upper and lower arches for some little time before applying the inter-maxillary force. This force was used in this particular case in rather a peculiar manner.

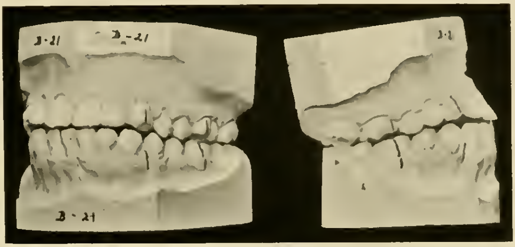


Fig. 18.

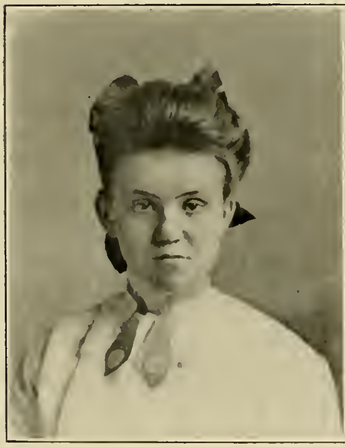


Fig. 19.

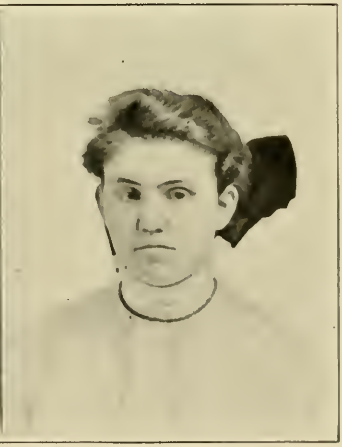


Fig. 20.

Figure 16.

You will see in this picture that the lower jaw was in mesial occlusion upon the right side, and in normal occlusion upon the left. A front view of the face shows the mandible swung to the left to a marked degree. I applied elastic force in the usual manner to correct the mesial occlusion upon the right, *e. g.*, from upper right clamp-band to a sheath-hook, as far forward as possible on the lower arch. The desired movement was accomplished in a compartively short space of time. The median line of lower arch was still considerably displaced to the left. To overcome this difficulty I applied elastics on the left side as we apply them for distal occlusion cases.

Figure 17. (Appliance showing pull of elastics.) This drawing is intended to show the manner in which I applied the elastic ligatures. The result of this use of the rubber pull was to swing the mandible to the right somewhat and bring the teeth into normal relation.

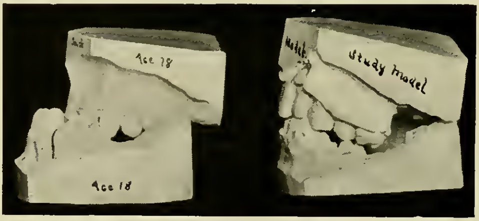


FIG. 21.

Figure 18. (Models after.) The face was improved considerably, though the upper and lower incisors at completion were inclined somewhat in the direction of the pull on each arch. The impressions for these models were taken on the same day the working appliances were removed, and the retainers adjusted. I would have liked impressions some months later, but the patient was going to the Middle West and it was my last opportunity. You will see that all the inclined planes tend to the normal. The application of the force is interesting, in that I believe there are no records where it has been so employed before.

Figure 19. Face before.
Figure 20. Face after.
Figure 21. Side models, before and at present.

This case is another of Class III, complicated by considerable loss from extraction. The upper first molars were both extracted. The right second molar has come down, but the left second molar has not appeared, though on the point of erupting. The lower first molars were also missing. The problem here was to get a sufficiently stable anchorage to bring about the desired changes.

Figure 22. (Drawing of appliance.) This drawing shows the means adopted to get an equal pull of elastic force on each side. The upper left bicuspids were banded, the bands soldered together, and a section of heavy wire soldered on the distal surface of the second bicuspid with a hook at the end to hold the elastics. This hook was carried distally just far enough to make the pull on either side equal.

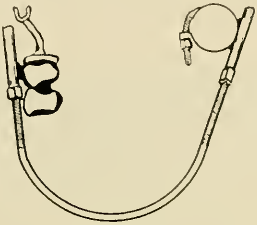


Fig. 22.

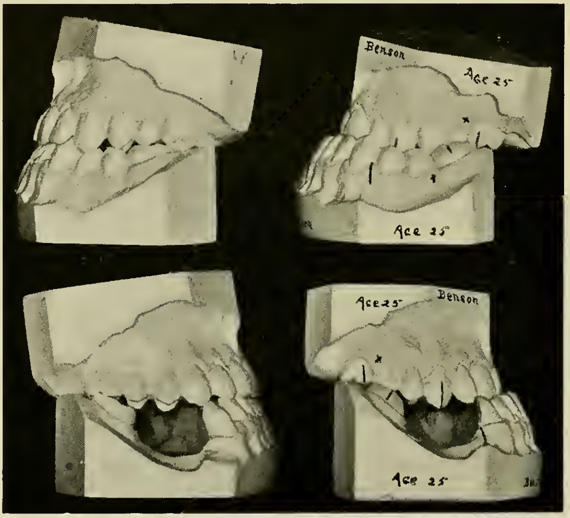
The study model shows the present condition of the case. This model was made from a wax impression taken a few days ago. The anchorage on the left, though it has been displaced somewhat, still has served its purpose very well. I have considerable yet to do on this case. I am sorry that I can not show you the completed models at this time.

In the treatment the upper six anterior teeth were moved labially first, expanded and separated. Then afterward, drawn from either side toward the median line, the elastic force afterward carrying the bicuspids mesially.

Figure 23. Here is still another mutilated case of Class III, that was made very difficult by reason of unstable anchorage. The upper first molars had been extracted. The lower right first molar and bicuspids also were missing. For various reasons it was a case in which I attempted simply to improve the occlusion, for in the original condition he had little or none. Where the teeth were missing in the lower arch I connected the cuspid and the second molar by a heavy bar soldered to bands. The upper arch was expanded and inter-maxillary force applied in the approved manner. The extreme lingual inclinations of the lower incisors I was unable to relieve.

Figure 24.

(Opposite side.) The use of inter-maxillary force usually causes more or less tipping of the primary anchor teeth. This tipping we must combat as best we may. In long drawn-out cases this tipping may become severe, though generally it does not reach serious proportions. It, however, causes us to occasionally shift the inclination of the tubes upon our clamp-bands. It is often necessary to spend considerable time in this operation. Dr. Pullen showed in Boston, early this month, his improved manner of attaching the tube to the band, whereby by simply removing the ligatures from the teeth, but not the arch, then grasping the tube with pliers, it could be bent to the desired angle without in any way affecting the tube or its attachments. If this mode of attaching the tube to band does not carry the tube too far buccally (and it does not seem to do so), and it will do all it says it will, it is a grand thing.



FIGS. 23 AND 24.

Comparative Tension of Elastic.

The degree of force applied, in the strength of pull of the elastic ligatures, seems to vary considerably in different men's hands. For myself, I have been using what I considered three different pulls—light, medium and heavy. But in experimenting to find just the strength of the pull for a certain distance of the elastic bands I was using I found to my surprise that the medium pull was heavier than I had considered my heavy pull. I had been using Bailey's "Violet" elastics for my light pull, Goodyear's "Election Bands" for my medium pull, and Angle's Rubber Ligatures for my heavy pull. The average length of pull in my cases of Class II, Division I, is almost 1 5-6 inches. The light elastic registered a pull of 5 ounces each for this distance, and 10 ounces for two elastics. The medium pull for same distance varied from 8½ ounces to 10 ounces for each elastic, and from 17 to 21 ounces for two elastics. Angle's ligatures vary from 8 to 9½ ounces for one elastic, and 16 to 20 ounces for two elastics. There is considerable variability in the strength of pull of the elastics cut from the same tubing. The figures I have given I found only after trying many elastics.

As yet I have never needed to use more than two heavy elastics in my work. I use light elastic pressure generally. If I see the desired movement taking place I do not care to hurry it along. In the cases I have shown you, the length of time to accomplish movement from complete distal to normal occlusion varies from three to six months. I start cases with a light pull, gradually increase it to what I deem the maximum pull for the particular case, keep such pressure constant until normal occlusion is reached, when I gradually reduce the pressure until I have the lightest pull that will hold the teeth in normal occlusion. I prefer to let as much settling occur as possible with working appliances in place, holding the teeth in occlusion by light rubber elastics rather than to trust to retainers at once.

In the preparation of this paper and the plates shown I have endeavored to bring out the point that where all the teeth are present, though the malocclusion may be severe, yet it is perfectly possible and feasible to bring them into normal occlusion. The cases where it was necessary to deal with mutilated conditions, and where, when the mutilation is severe, we can only hope for an improved occlusion, I have brought forward to show our limitations. The more we imitate the silent forces of nature, which are ever at work, quietly yet none the less effectively, the more humane and successful the results will be. This is but the trend of modern thought and practice. The disruptive forces of nature are rarely brought into play. So this disruptive force in orthodontia—which I may call extraction—destroying tissue, and causing shock, is rarely necessary. There is a better and a safer way. If you will permit me I will draw an analogy from Elijah of Holy Writ. He was a man of heroic type, who believed in fire, and famine, and the sword of destruction. But Elijah had to be taught that God and truth and right were not in the mighty wind, nor in the earthquake, nor in the fire—but in the Still Small Voice. So must the Elijahs of orthodontia be taught that truth and right and humanity and God are not in the disruptive and cruder methods of extraction, but in the Still Small Voice of the gentler, better way.

Discussion of Dr. Reoch's Paper.

Dr. Stanley. Dr. Reoch has said that it often happens that scientific minds, working independently of each other, may simultaneously startle the world with some great discovery. Indeed, this so often happens that the man is exceptional who can lay sole claim to any great thought or invention. The spirit of discovery is inherent in man's nature. It goes hand in hand with progress, and as man's needs increase it keeps pace. What wonder is it then that two men, with a common interest in solving complicated problems, should arrive at the same conclusions, at about the same time, and without any previous exchange of ideas.

There is a time and a place for "priority." By that I mean that in the discussion of scientific facts, before a scientific body, the tendency is too often to center the discussion upon the question of who is entitled to first mention in the discovery of a great truth, while the application of that truth, and its result upon those benefited by it is overshadowed, or entirely lost.

Dr. Reoch has alluded, fittingly and becomingly, to the origin of the intermaxillary force in the opening of his essay, and then followed with examples of the application of this indispensable force in the treatment of malocclusion. He has with truth said that this great discovery is burying the "extractionists" deep under the sod. The few remaining believers in mutilated dentures as a cure for certain existing evils are dying hard. But I believe even these few now show signs of weakening.

Dr. Reoch is most generous to this handful of exponents of false doctrine. He grants that extraction may sometimes be necessary, yet he states that he has not found it necessary in his experience, nor have I in mine; and I venture to say that the majority of those present—yes, I dare say all—will echo his words.

Intermaxillary force, in its usual form of application, is the keystone of the arch of modern orthodontia. Without it the whole structure would fall.

We may differ in our conception of perfect balance, or harmony of facial lines, but the differences lend no excuse for the extraction of teeth in the treatment of malocclusion. The *intelligent* use of the intermaxillary force can only produce the *best* result in any given case, while so-called "judicious" extraction has but one result—creating one deformity to balance another.

Dr. Reoch has shown a number of uses to which the simple elastic can be put. Practical cases teach us more than volumes of theory. We have received a number of sound practical suggestions which can not fail to be of use to us.

Undoubtedly more can be accomplished with this form of intermaxillary force (the elastic band) than any of the others mentioned. The inclined plane as used by Dr. Ainsworth has its place, though necessarily it can not supplant the elastic band stretched from one arch to the other.

I would like to discuss certain features of each case shown on the screen, but I fear it would consume too much time. One point, however, which one of the slides brought to my mind is of special interest. Dr. Reoch showed his method of quickly aligning buccally displaced molars. It seems to me that the application of the elastics from molar to molar as he described would be of great assistance to us in those cases where the lower molars are unduly inclined lingually, where it seems almost impossible to move them. I think we could apply the elastics as an auxillary to the expansion arch. The tendency would be to draw the upper molars lingually. This can be overcome by re-enforcing the upper molar anchor teeth in any way that is practical.

In correcting mesio-distal malocclusion I think we get a better result in the end by the gradual application of the elastic force. In retention I find the light elastic very satisfactory when worn at night, after the mesio-distal relation has been corrected, and if there is any tendency for the teeth to slip, have them worn through the day as well.

The case Dr. Reoch showed of a young lady, where the chin had gone to the left, I happened to see last spring as she hurriedly passed through New York. She came in for a few minutes. The inclination of the chin is almost absent now. The case was so very much improved that I felt highly gratified at Dr. Roech's result.

Dr. Henry A. Baker. Mr. President, I thank you for inviting me to discuss this paper. I also wish to thank Dr. Reoch for the compliments which he paid me in relation to the intermaxillary elastics. I do not know that I can say anything in regard to their merits that you do not already know; however, it may be interesting to you to know the history of their introduction.

Soon after the birth of my youngest son, his mother was taken very ill. As a result we were obliged to feed him by means of a nursing bottle. As time went on to our surprise and horror we found the pressure of the rubber nipple, slight as it was, had created a decided deformity in his delicate jaws, and when his permanent teeth erupted the result was a very aggravated case of what Angle classifies as distal occlusion.

I prepared models and studied the case carefully. My conclusions were that if I reduced his protruding upper teeth the lower jaw would still occlude distally, and to get normal occlusion it would be necessary to bring the lower jaw forward. Then the question arose as to how this could be accomplished. The intermaxillary elastic was the result. I decided that the best time to commence operation would be just before the eruption of the lower twelfth year molars, so that after they erupted they would assist in holding the remainder of the lower teeth in their new position. After laying out my line of treatment and deciding the best time to accomplish the same, I exhibited my models before the "American Academy of Dental Science" and outlined my proposed treatment.

This case was corrected in two months' time, and no other force was used than the intermaxillary elastics; that is to say, the teeth were brought into normal relations and allowed to settle into better occlusion before putting on retainers.

The probable cause of this rapid change was the use of much heavier elastics than we use to-day. I used them double, hooking them over the tubes of the lower anchor bands, in the same manner as is used to-day, then stretching them forward and tying them to the upper arch wire just in front of the upper cuspids with silk ligatures. It being my son's case, unfortunately I made no record in my book, but as I have said before, I commenced operations before the eruption of the lower twelfth year molars, and my son will be twenty-six years old his next birthday, which to my mind is an authentic record. Many years after the correction of this case Dr. Case wrote to me claiming priority of intermaxillary elastics. He also sent me publications wherever he had mentioned them, and his records would indicate that he made no great account of them except as an auxillary force to other methods. I do not care to go into a deep discussion on this point, as the profession knows very well my connection with intermaxillary elastics and what they will accomplish. I have received some very kind letters from Dr. Angle and others in the profession who have used them successfully in a great many cases, and I would also say that Dr. Angle has added greatly to their efficiency by attaching a hook to the upper arched wire, which enables the patient to apply them without the aid of the operator, and I give him great credit for the improvement. There is one more thing I wish to mention in regard to Dr. Reoch's paper, that is in relation to the last illustration that he exhibited, showing a case of prognathism. Some three or four years ago I advanced the theory that this was caused by habit, especially where there was a loss of several teeth in the molar region. My idea is that, being unable to masticate in the back part of the mouth, patients are obliged to use their front teeth, and as a result get into the habit of reaching forward, their lower front teeth tipping back to a marked degree. Everything that I have been able to learn corroborates my theory, and I ask you, gentlemen, to bear this in mind and get as much of a history of similar cases as possible. If we can establish the fact beyond a question it will be still another factor as an argument against promiscuous extraction.

Dr. Hawley. Just one word. I have an idea which I have not fully tried, but which I believe to be a good one. We all know, who have treated cases of the First Division of Class II, that there is a large overbite which is difficult to take care of. Dr. Reoch has thrown on the screen an illustration of the application of the intermaxillary bands, in an attempt to correct that overbite. I saw during the last summer the same plan worked out very beautifully, but undertaken in the beginning of the operation. Dr. McBride, of Dresden, in treating these cases, instead of putting the intermaxillary ligatures from the sheath hook back to the molar band, uses two, one going over the upper molar tube.

While I was visiting him this summer we improved that by putting a little spur on the mesial end of the tube on the upper molar band so as to carry the pull a little further forward. In this commencement of the forward movement of the lower jaw he starts to correct the overbite. That has been a valuable suggestion to me, and I look forward to a little quicker and a little better result in these cases in the future. That pull of the ligatures will also correct, or prevent, the outward tipping of the cusps of the superior molars. Instead of waiting until the closing of the case they should be started at practically the beginning of the work.

Dr. Casto. Dr. Reoch has given us an excellent paper, and I wish to thank him personally for it; also to express my appreciation for the great amount of work he has done in its preparation.

The essayist referred to some cases of Class II that I have been treating by using the intermaxillary rubbers on individual teeth in connection with an inclined plane. I do this for the purpose of shifting the occlusion, lengthening the bite and depressing the lower incisors. I have employed this method successfully in those cases of Class II where the lower incisors strike against the soft tissues lingually to the upper incisors, and where it is necessary to lengthen the bite, after shifting the occlusion so as to prevent the lower incisors from occluding too heavily upon the upper incisors.

Dr. Reoch, in describing the method, spoke only of using a bite-plate with an inclined plane on it and wires bent over the incisal edges of the upper centrals. This form of plate is a modification of the old Kingsley bite-plate, and was first used, I believe, by Dr. Angle. The wires passing over the edges of the incisors serve the double purpose of preventing the labial movement of the incisors and to prevent the plate from being forced into the soft tissues. The intermaxillary rubbers on the individual teeth may be used for the same purpose in connection with any form of an inclined plane. It makes no difference whether it be a plate or an incline after the fashion of the Davenport or Ainsworth pattern. The essential thing is to keep the force of occlusion upon the teeth to be depressed, and freeing those teeth to be elongated.

In cases where it is desired to increase the depressing force upon the lower incisors, and the elevating force upon the bicuspids, I have used in connection the method suggested by Dr. Case, namely: Bands are placed on the incisors with lugs pointing incisally. The lugs or hooks in the biscupid bands which point lingually are made larger so as to engage the wire spring and allow also of rubbers being placed on them. Bands are placed either on the first or second molars, as the case may require, with hooks pointing occlusally; a spring wire is then fitted around the arch, being adjusted so as to engage over the hooks on the molars, under the hooks on the bicuspids, and over the hooks on the incisors.

Dr. Hawley spoke of using the elastics on individual teeth at the beginning of a case, for the purpose of elongating the molars, and at the same time shifting the occlusion. That may be done provided there is a harmony in the size of the arches when the lower is set forward. But where there is practically no harmony in size or occlusion with the upper arch, some previous treatment is required. This must be done to establish a proper aid to accommodate the occlusion when shifted. The elastics may be used on individual teeth for retention for a limited time in ordinary cases of Class II. In such retention, they may be used either with or without an inclined plane. They may also be used advantageously in any case where it is desired to draw the teeth into an interdigitation.

Sometimes after the occlusion has been shifted a space remains between the upper cuspids and bicuspids; or the cuspids may not be fully erupted and located slightly mesially to normal. In such cases the elastic may be used to a decided advantage. This is done by placing bands on the cuspids and lower first bicuspids and then engaging the elastics over the hooks on the cuspids and under the hooks on the bicuspids, or the elastics may be extended from the cuspids to the lower first molars, depending upon the requirements of the case. There are many other conditions where the intermaxillary force can be used to advantage.

Yesterday, Dr. Rogers made some reference to the use of an inclined plane, made by adding another cusp on the lower first bicuspid.

I wish to say that at the Chicago meeting, more than a year ago, Dr. Robert Dunn, of San Francisco, gave a clinic on that very thing. I have used it effectively. I have also put an inclined plane on the lower second bicuspid, allowing the incline to strike mesially to the lingual cusp of the upper second bicuspid.

The inclined planes used on individual teeth in connection with the intermaxillary elastics are valuable in retention, where it is necessary to change the position of the teeth slightly in a mesial or distal direction.

Dr. Varney E. Barnes.

So far as I know, the credit for the additional cusp is due to Dr. Lourie. I think he showed it at the Philadelphia meeting of the American Society of Orthodontists. It is not a little amusing to me to notice these Angle students taking up some of these appliances and things which have been relegated to the past, such as "inclined planes," "special appliances," etc. It is a pretty good sign, and means that broader thought prevails.

I put a big question mark after the statement that the intermaxillary rubber ligatures are effective for retention. What are you doing while holding those rubbers on the teeth? You certainly will not expect a stationary retention or even rest. It is a serious question, and that kind of anchorage is a confession of a failure in retention and regulation.

Another point. Dr. Casto has spoken well with reference to harmonizing of the arches before swinging the mandible forward. I have had some success with inclined planes soldered to the lingual of a Case retainer. They should be used after the teeth are put in harmonious relations in each jaw, and then they will aid in producing the proper relation of the jaws. In many of these cases of distal occlusion we will not succeed in retention.

I noticed in one of Dr. Reoch's illustrations a *space distal to the cuspid tooth. That* is a *diagnostic sign* that the upper *molars* and *bicuspids* have been *moved too far distally.* In most of those cases the lower jaw is too far back, and in trying to compromise you will move the side teeth too far and cause this space and fail in trying to force the incisors and cuspids back. I believe the intermaxillary force should be an auxillary force only.

Dr. Reoch. In showing the slides I forgot one. It shows a method of applying intermaxillary force that Dr. Rogers has used to advantage. A hook is soft soldered to the end of the upper or lower arch, as the case requires, and so arranged that all the pull of the rubber ligature is transmitted by this hook to the arch, in this way forcing the teeth ligated to the arch mesial to the anchor tooth, in a mesial direction, without a stress upon the primary anchor tooth. It is a method that can be employed to great advantage in certain types of cases.

I wish to thank you for your kind attention and consideration of this paper.

An Appliance for Expanding the Dental Arches, Thereby Increasing the Size of the Nasal Passages and Superjacent Bones.

Dr. E. A. Bogue, New York.

I wish to express my regrets now that this Society of Orthodontists was not formed when I was a child, because my incisor teeth shut end to end, and I can not therefore enunciate certain words correctly.

I started last July to write a paper controversial to my friend Dr. Angle, hoping he would be here. When I found he would not be here I hitched it on to a few disjointed items, which I hope you will excuse in lieu of a paper.

In the Items of Interest for June, 1906, I read in a recent paper of Dr. Angle's that "the deciduous teeth almost always erupt into ideal normal occlusion, and the child denture is not only perfect in form in part and in whole, but in location with the rest of the face and head, so that there is beauty, harmony and the highest efficiency . . . so, when the first molars erupt they do so under the most favorable conditions, unhampered by predecessors or by those teeth anterior or posterior to them, the jaws having been lengthening for years for their coming, and instead of being in any way hindered in their eruption they are, on the contrary, *guided into* and *guarded in* normal positions by the beautiful normally built child denture anterior to them."

Dr. William J. Brady, of Iowa City, in discussing Dr. Angle's paper says: "The action of heredity is the chief, if not the only controlling force that settles the position of the teeth named, and they are so placed that when they erupt they have only to emerge through the tissues covering them when they are in their correct places. This is why the temporary teeth are always practically regular, which fact is one of the best established in relation to teeth."

Dr. Fletcher, of Cincinnati (quoting Talbot on irregularities of the teeth), says: "The deformity always commences at the sixth year and is complete at the twelfth."

Either I have misunderstood or all these gentlemen are mistaken. I present for your consideration a number of cases of deciduous teeth taken from among my own models, the cases occurring in my own practice or in that of my son, all showing distinct irregularities in the positions of the temporary teeth, and several of them showing such extensive irregularities that if the contention of Dr. Angle is correct, and I believe it is, that the first permanent molars are guided into their places by the child denture anterior to them, then the first molars can not possibly be in normal position.

If the first molars were guided into correct articulation there would be no cases in adolescent life of dislocation or malposition, either unilateral or bilateral, to call for the reciprocal force, which has proven so efficient in correcting these ofttimes perplexing and troublesome irregularities. Irregularities arise very early in life, according to Dr. Fletcher's own suggestion; their cause may be antenatal, and certainly are if heredity plays the part that Mr. Burbank teaches us, and that Darwin originally propounded.

But I think that influences that come into operation *after* birth, and which we can understand much better than we understand heredity, are mainly responsible for determining the position of the teeth.

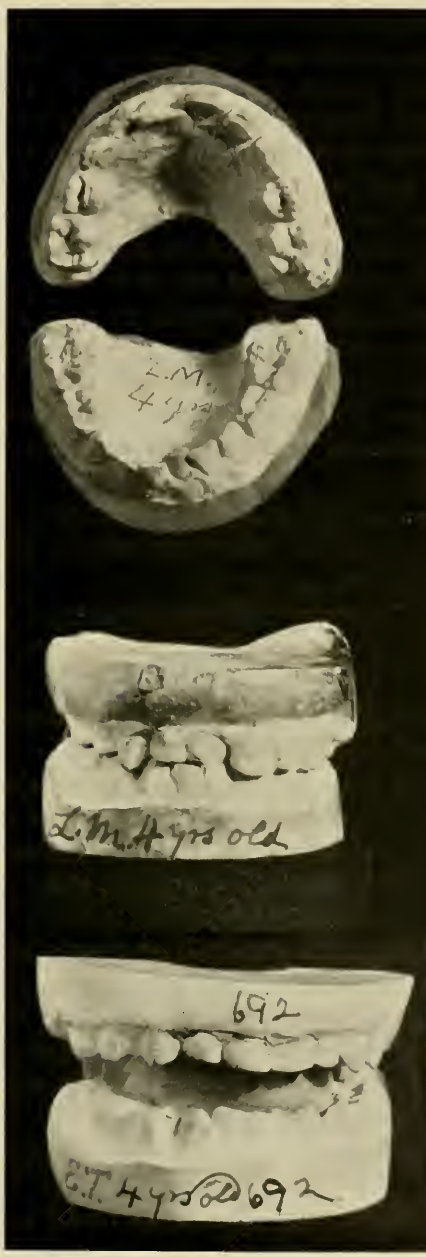
Close observation of minor deficiencies readily show that irregularities may be found among the temporary teeth about as often as among the permanent ones.

Irregularity Prognosticated by Temporary Teeth.

My own experience is that all serious irregularities of the permanent teeth are indicated by the positions of the deciduous teeth, and that at five years of age or earlier, one may detect these irregularities, and, in many instances, avert them by prompt action in encouraging normal development by the removal of some obstruction which nature, unaided, is not able to overcome.

I present to you the case of a little girl eight years old. I found both arches a little too narrow, according to the Hawley measurements. The lower incisors were posterior to normal. The right lateral was 3-16 of an inch posterior to the other three. Upon rearranging the teeth on a plaster model I found the central incisors needed to be advanced about an eighth of an inch; consequently, in order to make a perfect arch with the cuspids the whole lower dental arch needed to be broadened about 3-16 of an inch and the four lower incisors made into a perfect arch on those lines. I placed bands with vertical tubes around the second lower temporary molars, and an expansion arch engaging those tubes was placed on the buccal side of the dental arch. By utilizing the temporary teeth for purposes of regulation all injuries to the permanent teeth from fixtures are avoided. On the lingual side of these bands a wire soldered to each band acted upon the four adjoining teeth, drawing them simultaneously outward as the external wire arch expands. On the lingual side of the left lower molar band was also soldered a gold and platinum spring wire, which, having been bent to the form of the perfect arch, engages beneath a little spud attached to a band on the right lateral incisor, and will eventually, if kept in position, advance the right lateral incisor to its proper place in the arch as well as all the other three incisors, so soon as the arch shall have been broadened enough to receive them.

On the upper teeth bands were similarly placed upon the second temporary molars with lingual wires touching four teeth on each side, the same as below. Outside the dental arch was a wire expansion arch engaging in horizontal tubes attached by swivels to the upper molar bands. This arch has a thread cut on each of the ends for two nuts, the forward one designed to compress spiral springs surrounding the arch wire just forward of the horizontal tubes. The posterior nuts are designed to prevent the arch wire from drawing the incisors too far forward, and are also designed to prevent losing the fixture off. The two upper central incisors are surrounded by bands having a little spud on the lingual side to engage small ligature wires that bind the incisors to the arch wire. The resiliency of the spiral springs will carry these teeth forward until the movement is stopped by the posterior nuts. At the same time the wire expansion arch will draw the four molars on each



FIGS. 1, 3 AND 5.

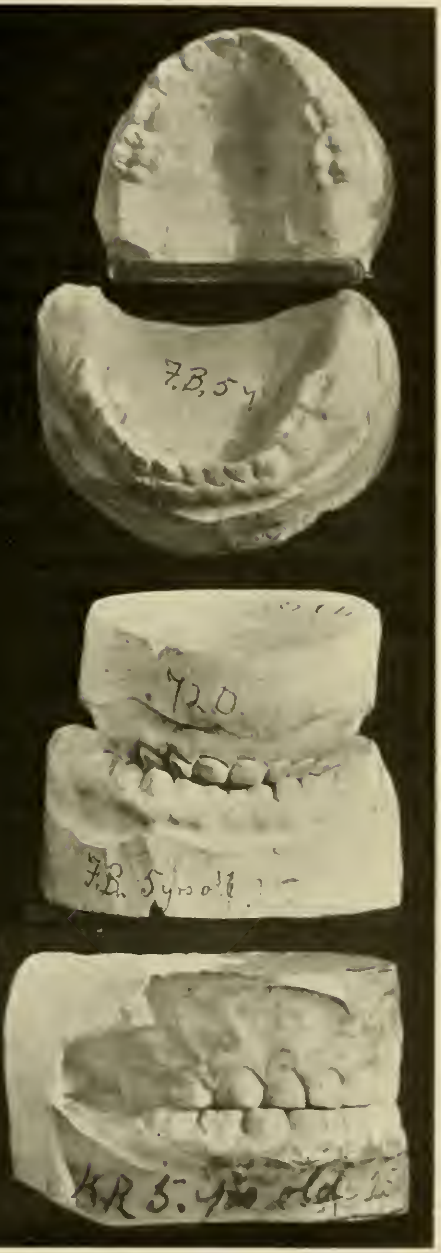


FIG. 2, 4 AND 6.

side outward to correspond with the outward movement taking place with the lower teeth, and as these temporary molars move laterally outward they carry with them the crowns of the permanent bicuspids that are embraced by the roots of these temporary molars, thus broadening the entire upper arch. The plaster models of the case, taken after the fixtures were in place, explain perfectly the position of the fixtures, which should be maintained until the teeth are in position.

It will be noticed that the lower incisors and the upper central in that mouth, Fig. 1, and the entire upper arch, are much smaller than this other one, Fig. 2; the one is four years of age and the other five.

Fig. 4 is the same case—five years of age. The irregularity is readily seen. The lower molars are entirely outside the upper arch. The upper central incisor of Fig. 3, is within the lower arch. Adenoids were developed in Fig. 4 at six weeks of age. The mother found at that time that the child was sleeping with the mouth open, and on examination adenoids were found.

Fig. 5. This case was left open in order that the irregularities of the temporary teeth might be seen. Patient was four years of age. The other, Fig. 6, is five years of age, and bites end to end.

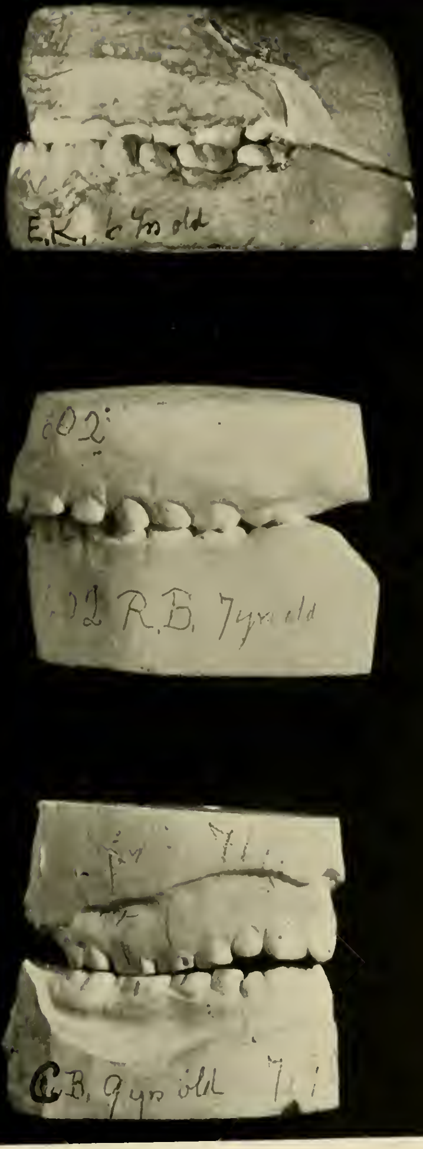
Fig. 7 was five or six years of age, and the entire lower arch closed outside the upper. The difference in size between the upper and lower you will note in the next.

Fig. 8 is the same case. The difficulties of correcting that particular case was augmented by the fact that the child lived in Paris.

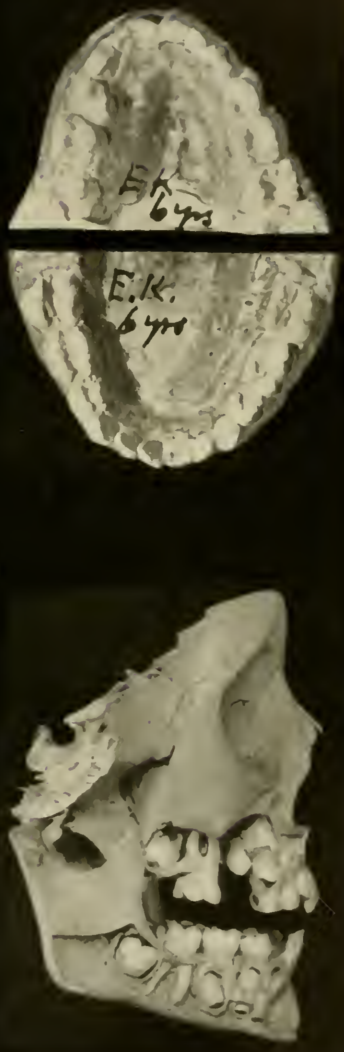
Fig. 9 is seven years of age, and the adjoining one, Fig. 10, nine years old. Fig. 9 is the case I spoke of yesterday, where the model at seven was carefully measured—again at eight and ten, and our respected president, in measuring the last two, did not find any difference, although two years had elapsed.

Fig. 11 is an interloper, put in to show how the loss of a temporary tooth and the occurrence of a cavity of decay will cause the permanent tooth to bodily come forward, apices of roots and all. So there the principal molar actually occupies another position from the correct one, even though the anterior temporary teeth were in place. It is the most vivid instance of how the loss of a temporary tooth can result in the serious irregularity of the permanent teeth that I have come across in my researches.

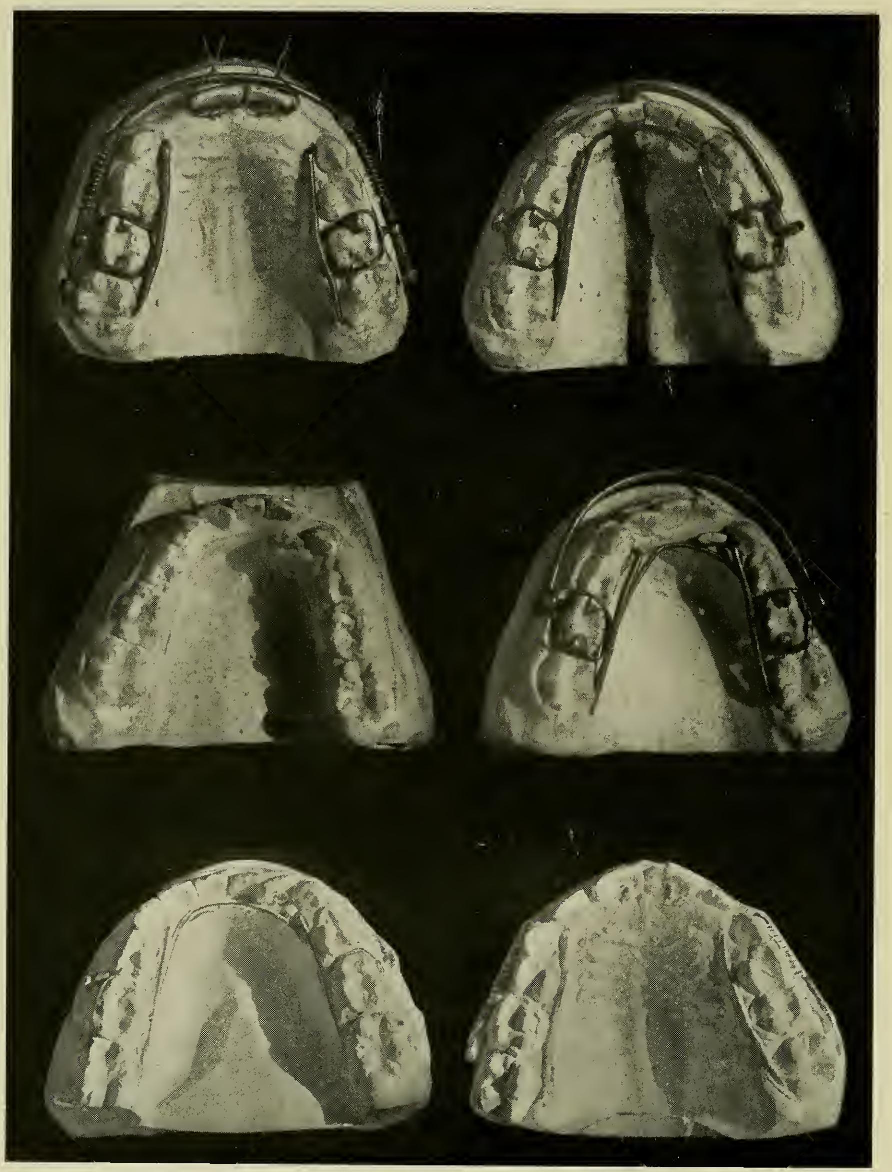
Fig. 12 is the case I have been describing. The lower model was cut in two in the middle and broadened. The bands were placed upon the second temporary molars as described. The wires, both above and below, engaged with four teeth on each side, and the arch outside was



FIGS. 7, 9 AND 10.



FIGS 8 AND 11.



FIGS 12, 13 AND 14.

set to do the work which I have described. On the lingual side of these bands the wire acts on four teeth.

Fig. 13 is the lower arch. The right lateral incisor was away in, and back of it is the gold and platinum wire, which, when inserted runs away back to the left molar, but when it shall have done its work, that right end will come exactly to the point between the right lateral and cuspid when the teeth are all regular. Those fixtures were put in on the sixth day of July last. I have not yet seen the patient, but am hearing good reports from the parents. I wrote Dr. Angle and requested the name of a good orthodontist in the neighborhood. I sent the name of that orthodontist and received models.

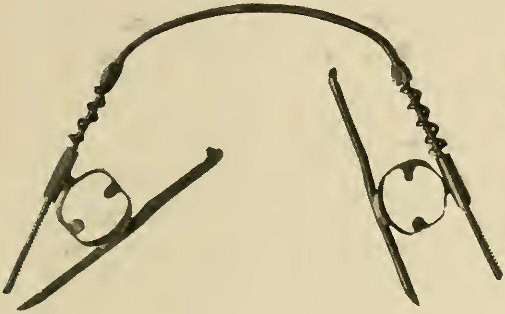


FIG. 15.

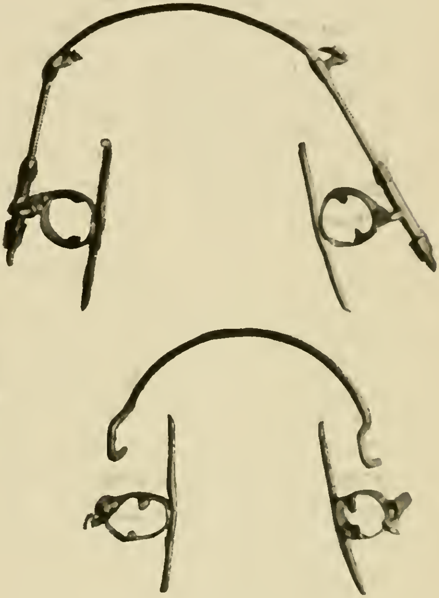


FIG. 16.

Fig. 14 is the model as sent me. The upper arch has spread not quite a quarter of an inch, and I hope Dr. Hawley will give his views as to how nearly it corresponds with that arch of his. The lower arch has correspondingly expanded and the incisors have been pushed forward to the point you see, but the end of the gold and platinum finger spring wire was crowded down below the spurs on the incisor bands so the ends stuck out against the gums, and therefore the end of my finger wire was cut off, much to my regret. I was keeping this case for this meeting, and I earnestly wanted to show it complete, showing what could be done by an apparatus designed on the model, where the regulation was done on the model, without ever touching it again. The arch wire, the Ainsworth wire, was taken off to be broadened about one-eighth inch in order to accomplish something that I desired. It was accidentally broken. The orthodontist did not telegraph me or I would have sent a duplicate. The bands on either side were taken off and an Angle fixture inserted. The parents wrote to know what to do. I said let it alone, I am familiar with the Angle fixture. It does good work, only it requires constant attention, whereas the fixtures I put in July 6th worked on until November 8th without any further attention.

Figs. 15 and 16 are the fixtures illustrated. Notice the drop hook, etc. Those hooks can be turned up when the child is eating, under the cheeks; then the child can turn them down again and hitch on the rubber.

Discussion of Dr. Bogue's Paper.

Dr. J. Bond Littig.

While I believe that Dr. Angle has authority for his assertion, if he takes up the text-books on the subject of orthodontia as published to-day—that the majority of temporary teeth erupt normally—I remember when I was a young man that Dr. Bogue read a paper before the Odontological Society, which was written by Dr. Davenport, stating that there should be no extraction of teeth for the purpose of "regulating," as we used the term then. We were really anxious about Dr. Bogue at that time; we thought he was getting a little off his head, and so men brought models invariably, to prove that extraction of teeth was not detrimental to the shape of the arch and mastication. Dr. Bogue has kept at that all the time, until he is almost like Mrs. Eddy, with a congregation around him, and the people have come forth and said he is right. He was first to indicate to us that we must not extract; that there was something better. He tells us that the teeth of the infant or the teeth of the child of seven, of six or of three years of age, are often entirely irregular, and I rather think he is right. It is an awakening to me, because I have always taken up all these things, and all I have seen, with three exceptions, have appeared to be regular; but perhaps I did not go back far enough. He is one of these men that is always searching for something radical, and he comes out with it and I do not dispute it for fear I might be caught in the same trap as when I disputed him about the extraction of teeth. I am convinced I have extracted many teeth that should not have been removed. I was taught that way, and that is my only excuse. Facts are stubborn things, and when Dr. Bogue brings models and appliances you can see how ingenious he is. Not that he has invented appliances, but he has taken those from Ainsworth, Canning and others and has correlated those appliances to suit individual cases. Not many of us would have thought of it.

Dr. Hawley. I have been much interested in this work Dr. Bogue has been doing, and it is needless to say I have been much gratified by it.

In regard to the first part of the paper, from one standpoint of the proposition, that the temporary teeth guide the permanent ones into a perfect position, I think Dr. Angle was right. That is, in case the temporary teeth are normal, and none of them lost prematurely, and I do not question but that the first molar, in normal cases, is the most valuable landmark for classification in the mouth. But it seems to me that any man will notice that in a large number of cases the temporary teeth are not in normal position, and in those cases they do not guide the first molars into normal occlusion.

I think there can be no question but that there are large numbers of cases where the temporary teeth are not in normal occlusion. I have observed many myself, and Dr. Bogue has shown some on the screen. I have had two cases called to my attention since I have been in this city of complete distal occlusion in the deciduous teeth. In those cases the first molar will hardly be guided into its normal position.

Regarding the second part of the paper, I saw these appliances last July, and I must say that Dr. Bogue was attempting something I would not care to undertake myself. Last night I saw the models of this case and I am certainly astonished at the results that have been attained. The arch was bent with just about the right amount of spring, because in four months it has widened that arch just a little more than is necessary (if my charts are right), and that extra expansion is very vital considering the retention. I think if I had that arch under my constant control I should have exceeded the indicated width by just about the amount that he had done. I would compliment Dr. Bogue very highly because of the way in which he has adjusted those appliances. I think it is remarkable. He has opened a field of possibilities in managing such cases that I have not thought of, and I do not believe many of us have. This patient has been out of his control for four months, and yet the appliance has worked correctly. Only a little more attention to the lower arch was needed.

I can hardly express my gratification at the results that have been gained by Dr. Bogue.

Dr. Varney E. Barnes. I had the courtesy shown me of being permitted to read Dr. Bogue's paper, and of also seeing the models and hearing him explain the working of his appliance. He has certainly given us a marvelous apparatus; especially marvelous for those cases where we can not see our patient two or three times a week, or even once a week.

I think the Doctor's criticism of Dr. Angle and Dr. Brady with reference to their position as to irregularities in the temporary teeth is well taken. Dr. Bogue, as you know, has been working along these lines for some time. He expressed his conviction over three years ago that certain irregularities were shown in the temporary teeth, and that operations on them should be started very early.

Last July I published an editorial criticism of Dr. Angle's statement with reference to the first permanent molars, saying "that they could not be the key to diagnosis when posterior to any irregularity of the temporary teeth." Later I had an article in December, 1906, *Dentist's Magazine,* covering irregularities of the temporary teeth, wherein I stated that all serious irregularities of the permanent teeth are foreshown in the temporary dentition. It is not a mere statement, but the results of the investigations of some years.

Dr. W. M. Dailey published a paper in 1905 indicating that he had observed the prevalence of irregularity in temporary teeth.

I am surprised to hear Dr. Hawley say that most of these irregularities are not shown in temporary teeth.

In the first class of Dr. Angle's classification there are 692 out of a thousand cases in which the irregularities in permanent teeth are anterior to the first permanent molars. Indications of those irregularities would show in the temporary teeth. If you do not believe it, watch the little patients. Ask the mothers to bring in the sisters and brothers of the patients under your care, see the babies soon after birth, and note the characteristic lip relations, etc. Get impressions from two years and ten months up, as I have done, and you will conclude as I have, that temporary irregularities precede those of the permanent.

I disagree with Dr. Bogue on one point. That is, we need not pay a great deal of attention to pre-natal conditions. This need not detract in any way from post-natal conditions. C. Stanley Hall, in his "Psychology of Adolescence," says: "One of the greatest causes of the decay of ethnic stock is loss of mammary function."

What did that mean? That child does not get enough nutrition, and does not develop thoroughly because the conditions are wrong with the mother. We must consider all these things. They are at the very foundation of our work. The irregularities are shown, as Dr. Bogue has indicated, in the temporary teeth, and I am glad to be able to corroborate his statements and commend his excellent paper.

When I received the programme of this meeting I saw Dr. Bogue's subject dealt with the expansion of dental arches, thereby enlarging nasal passages, etc. It is true the roots of the decidous teeth will influence the cusps of the permanent teeth beneath them, and make the jaws increase in breadth and length. At eight or nine years of age, however, work on the temporary teeth would not amount to much because of the absorption of the roots of the temporary teeth.

The Doctor's appliance will be a great aid in many cases, but there are more cases where the appliance *will not influence the roots* as much as the crowns. I believe we need to pay more attention to the root positions. Then if they are put right, the crowns must be.

Dr. Bogue. It is some time now since I have looked at my orthodontia work as the mere regulation of teeth That is almost secondary, and that perhaps explains the title of the paper as published in the programme. I can not resist the examination as to narrowed arches, adenoids, imperfect breathing, imperfect nutrition, psychical defects, and all that sort of thing, every time one of these little patients is brought to me. I think it is about six years since the paper was brought before the American Medical Association, in which one case only was described. Whether that case was successful, you may best judge from the fact I have had the sister, and now have another brother. Those children all had adenoids. There was an effort at recurrence in one of them. Once the expansion arches were put on, there was no further recurrence of adenoids. I do not recall a single case where there was a recurrence after our work was done, which shows the relationship between naso-pharyngeal difficulties and orthodontia.

I think Dr. Barnes, in referring to pre-natal conditions speaking of children who fail of proper nutrition before and after birth, touched upon a point of which all of us know too little.

Dr. Pullen asked me to speak as to the difference between spring and intermittent pressure. A few years ago my whole attention was given to the inclined plane and screw, but when I got hold of Dr. Ainsworth and his apparatus, and saw the patients, I began to wonder if something else would not answer as well, and maybe a little better. I have applied it now, I think, in about forty-two cases, and I am firmly convinced of its effectiveness. In the case of the little girl I have told you of, the apparatus was arranged without any pain, and from July until November, when the orthodontist took the fixtures off, absolutely no suffering was experienced by the child. She did not know what was being done. I think that instance would also answer Dr. Pullen's question as to the propriety of using this apparatus.

The apparatus which I have taken pleasure in showing you to-day is not adapted to a great many cases, but I hope it may be of service to my brethren some day in the proper cases. One more reason for bringing it before you is that it shows a way in which multitudes who have not the wealth to apply, say to any of you gentlemen, for relief, may yet have the recourse of going to some one who will come up and be able to apply fixtures, and will do the work at a price within their means.

I owe also to Dr. Ainsworth the inception of the idea of putting on fixtures and leaving them there to do their work. It is not all original; I think he said it was an accident in his case; I do not wish to claim that at all.

A Case of Double Resection of the Mandible.

By W. O. Talbot, D.D.S, Biloxi, Miss.

For several years there have been rumors of a case of double resection of the mandible in New Orleans. The operation was said to have been performed for the purpose of reducing the protrusion of the lower jaw. Since marked cases of protrusion of the lower jaw are so common in this city, and there has been only one or two other such operations authentically reported, and since this class of cases is the most difficult for the orthodontist to handle successfully, I have been particularly interested in learning the facts connected with this case, and the results obtained.

About four years ago a male person, age 38, presented himself to a surgeon in New Orleans and asked to have a portion of his lower jaw removed to reduce the prominence of his chin. This was an extreme case and the prominence most disfiguring. The surgeon advised against the operation, but the patient insisted and said that he was determined to have the operation performed, as he had heard that it could be done. Other surgeons were called in and the operation finally determined upon. The resection was made on each side mesial and distal to the first molars, which teeth with their contiguous bone were removed. This operation severed the nerve and the principal blood supply of the anterior section of the jaw. The bones were drawn together and held by wires passed through each of the ends. No splint was used in this case. Necrosis followed the operation, and it was some time before the patient recovered. In this case a deformity was corrected, and finally there was some union of the bone, but it is questionable if the patient was greatly improved, as there was a disfiguration on each side opposite the field of operation and the symphysis dropped down. The patient is now able to chew a little. The surgeons in this case recognized the error in operating so far back on the body of the jaw, and now say that they consider the region of the first bicuspid the proper field for operation in such case.

Discussion.

Dr. McKay. Provided this is the case I think it is. I have heard it commented upon several times. It has been pointed to as a botch of what could be a proper operation if done according to a correct method. It was done very clumsily, and this case should not be accepted as evidence that such an operation is not warranted in certain conditions.

Dr. Ottolengui. Any deformity is possible. I am willing to go on record as saying that a real protrusion of the lower jaw is even rarer than a real protrusion of the upper. So-called protrusions of the upper jaw have been so diminished in numbers and the extent of the protrusions that a real protrusion is beginning to be looked upon as rare. I have seen a number of what we call Class 3 cases, and it has been perfectly marvelous after treatment and correction—which naturally did not shorten the mandible any—how different the profile would look when the upper jaw had been developed.

In the great majority of these cases, if the upper jaw is fully developed by treatment, and the lower teeth are really moved further out instead of further back, the apparent protrusion of the chin will disappear.

The Rotation of Molars.

(a) Methods of Rotating Malposed Molars.
(b) Prevention of Rotation when Used as Anchorage.

By J. Lowe Young, D.D.S., New York.

Read before the American Society of Orthodontists.

Molars in torsal occlusion are not very common where teeth have not been extracted, and we more often find upper first molars in torsion than any of the others.

In the vast majority of cases the molar immediately distal to an extracted tooth, whether it be an upper or lower, drifts mesially and lingually and rotates at the same time (Fig. 1).

In Fig. 2 is shown the occlusal view of a case where the right lower first molar has been lost and the second molar has drifted forward to take its place without rotating. This may be due to the almost perfect occlusion (Fig. 3).

Where the lost organ is to be replaced by either fixed or removable bridge work, the prosthodontist, if he understands occlusion, will appreciate having this tooth properly aligned.

Previous to the thorough understanding of the importance of occlusion, the rotation of malposed molars was never attempted; and why should it be, for they did not show, and, as the esthetic effect was all that the orthodontist looked for, their attempts were usually confined to the upper front teeth.

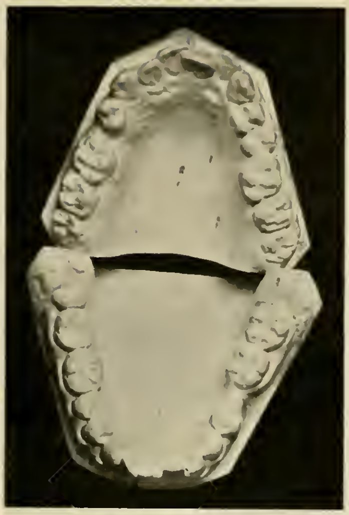


FIG. 1.

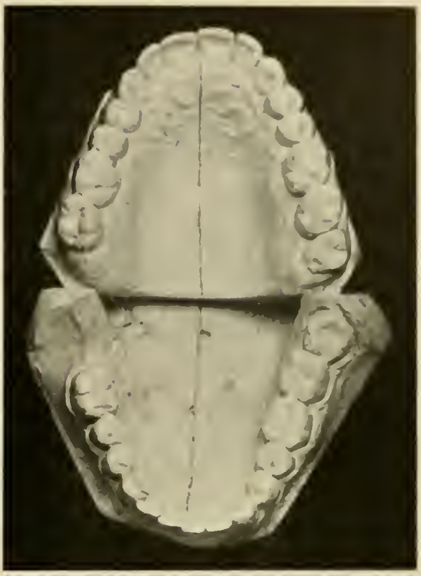


FIG. 2.

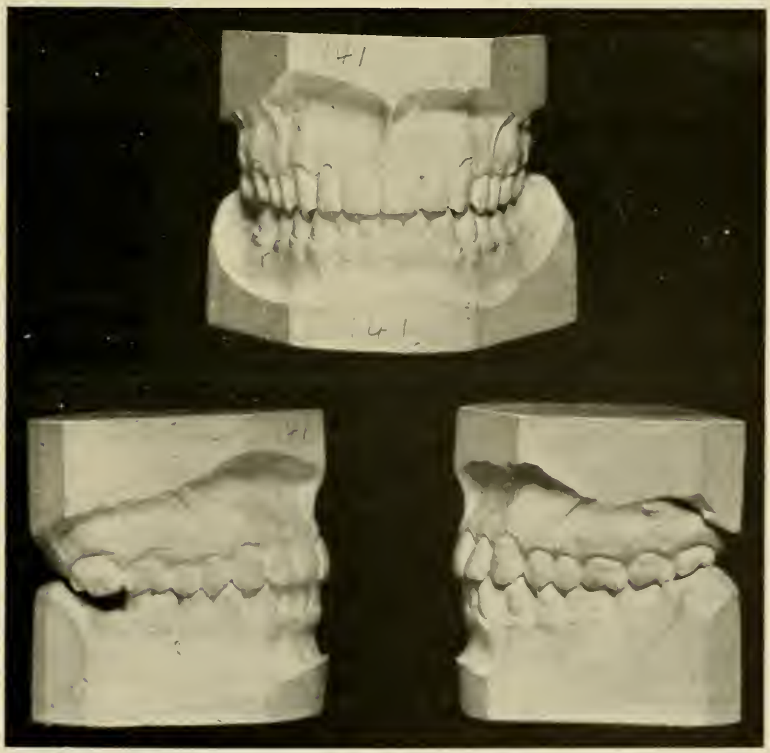


FIG. 3.

The molars most often found in torsal occlusion are the upper first, and they are usually found with the mesio-buccal cusp lingual to normal, and the disto-buccal cusp buccal in relation to the mesial cusp (Fig. 4). If we have the reverse of this position it would be a very simple matter to rotate them with the expansion arch alone.

Careful measurements show that an upper first molar in full torsal occlusion can usually occupy seven one-hundredths of an inch more space in the arch line than if normally placed. (By complete torsion is meant that the mesio-buccal corner of this tooth is in contact with the disto-approximal contact point of the second bicuspid, and the disto-lingual corner is in contact with the mesio-approximal contact point of the second molar.) This holds good whether the molar measures thirty-seven or forty-eight one-hundredths of an inch in its mesio-distal diameter. It is not often, however, that we find these teeth in complete torsion.

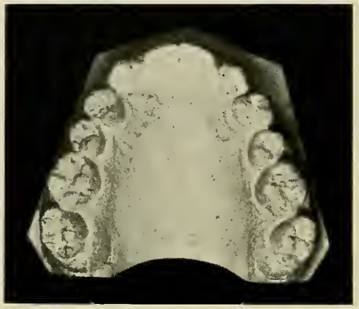


FIG. 4.

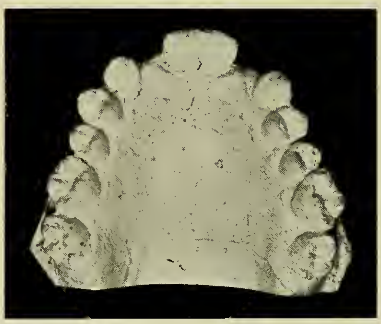


FIG. 5.

When we realize that complete torsion of this tooth can be the cause of all the teeth anterior to it being misplaced one-quarter the mesio-distal diameter of a bicuspid, it must be obvious how essential it is to properly rotate it.

Previous Efforts at Rotation of Molars.

The first record that I can find relative to the rotation of molars is by the man who has written the most on the importance of the occlusion of the teeth as a basis for the correction of irregularities, namely, Dr. Edward H. Angle. In his sixth edition of "*Malocclusion of the Teeth*" he has explained his accomplishment of this movement by the use of the expansion arch alone. I have employed this method, sometimes with success, but more often with failure

(Fig. 5), and these failures have prompted me to say something on this subject, feeling that it might be of interest.

At our last annual meeting Dr. Wm. O. Talbott, in a clinic, showed a device for rotating malposed molars, which at first seemed to meet all requirements, but personally I have not been very successful with it.

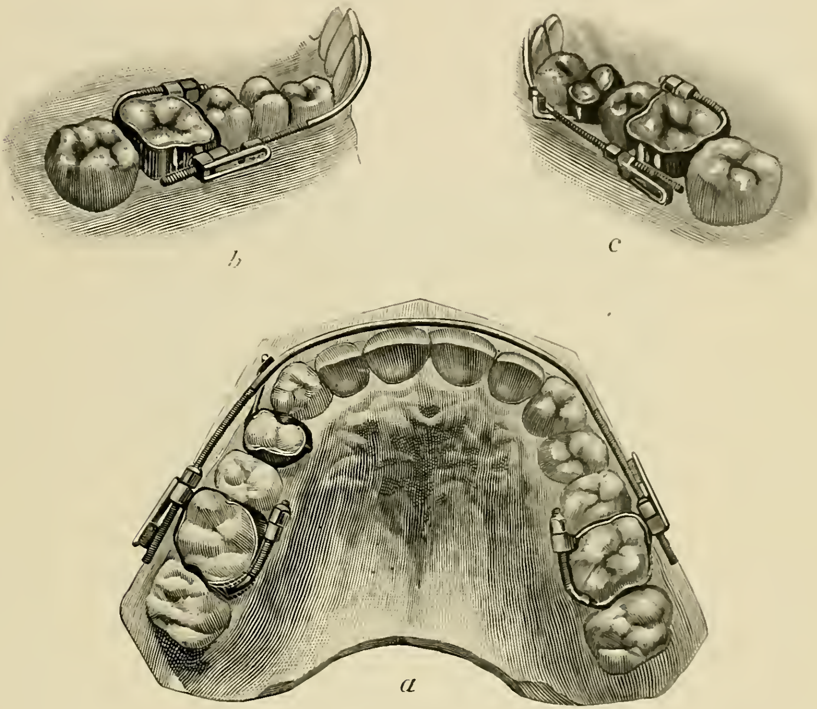


FIG. 6.

Dr. Talbot has kindly supplied me with a description of his appliance, in his own language, which I am pleased to quote as follows:

Dr. Talbot's Appliance.

"For rotating molars the appliance consists of a wire loop attached to a piece of short tubing on the buccal side of a clamp molar band (Angle's Band No. 2), used in conjunction with a threaded arch (Angle's Expansion Arch "E"), with separating rubber intervening between the loop and the arch (Fig. 6). The wire loop is made of gold spring clasp wire about 21 gauge, and should be three-eighths to one-half inch in length, the free ends of which are soldered to a short piece of tubing. These loops may be so attached to the tubing as to extend mesially or distally to the tooth to be rotated, as the case may require the mesio-buccal cusp or the disto-buccal cusp to be moved buccally. If the loop extends mesially (Fig. 6 B), it should be attached to the tube in such way as to allow the nut on the arch to pass easily between the loop and the molar band, and rest against the mesial end of the tube so as to support the arch, as shown in Fig. 6 B.

"If the loop extends distally to the tubing, the free ends of same should extend just mesially to the tube so as to lock the nut on arch and prevent its being rotated by the friction of the cheek (Fig. 6 C).

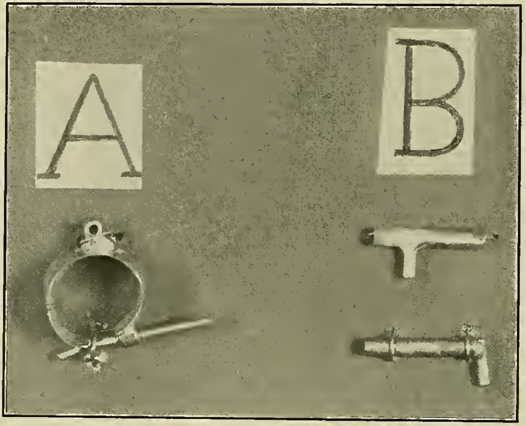


Fig. 7.

"The advantages of the wire loop over a flat spring are that it will hold the rubber better, it makes a better spring, and it is less irritating to the cheek.

"The piece of tubing should be one-eight of an inch long, the thickness used for jackscrews, and sufficiently large in diameter to allow the arch to move freely when placed in it.

"This form of attachment is simple anchorage, and should not be used in cases requiring stationary anchorage on the molars, as when great pressure is put on the expansion arch in moving the anterior teeth. However, it is indicated in such cases, after the teeth have been aligned in the arch, if the molars should need rotation.

"For rotating bicuspids, a lever is made of round gold clasp wire, about gauge 21, shaped as shown in Fig. 6, A and C. One end is attached with hard solder to a band made to fit the tooth to be rotated.

The band should be cemented to the tooth, and the lever allowed to extend mesially or distally, according to the direction of the rotation required, and rest on the buccal side of the expansion arch. Wedge rubber is used between the lever and the arch to produce the rotation. This gives a lever three times as long as when the wire ligature and wedge rubber are used, in which case the length of the lever is only one-half the diameter of the tooth. As rotation takes place the lever and the loop may be readjusted by bending with a pair of pliers."

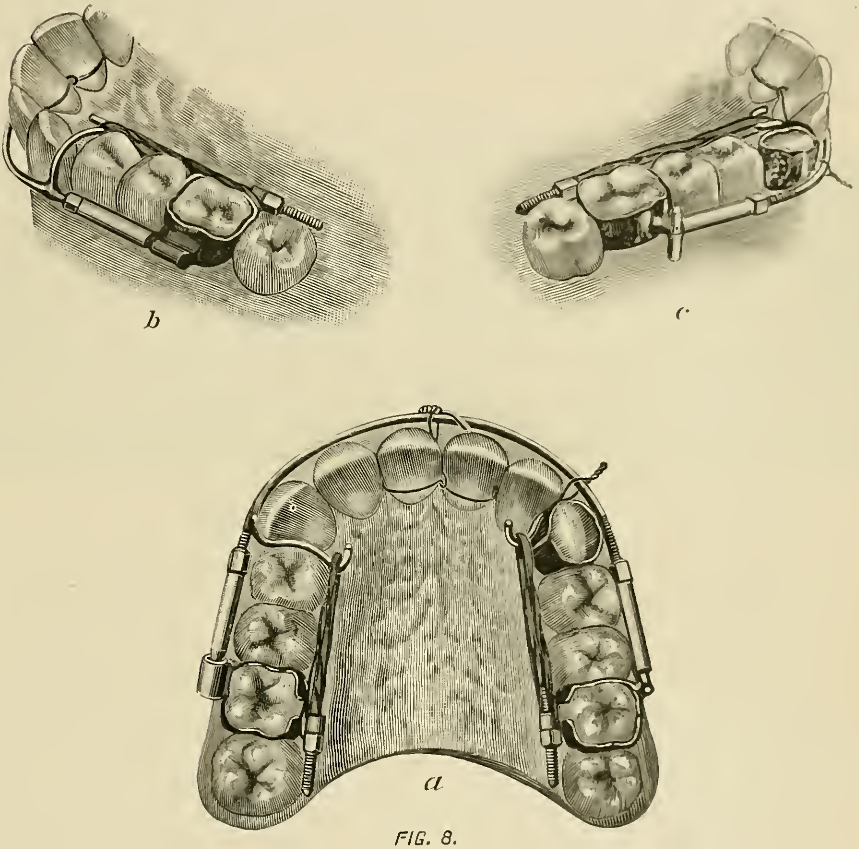


FIG. 8.

The application of the plain band with spur as used on the incisors, with the rubber wedge between the arch and the opposite corner from the spur, makes the rotation of these teeth absolutely certain and the force applied reciprocal.

Dr. Young's Appliance.

If this same principle can be applied to the molars the result will also be satisfactory. This can be accomplished by fitting a No. 2 band to the molar with the screw directed distally. On that part of the band over the mesio-buccal corner solder a short tube parallel to the long axis of the tooth (Fig. 7 A). On the pipe of the D band solder a piece of wire at right angles to fit into this short tube (Fig. 7 B). This gives a hinge attachment between the band on the tooth and the pipe in which the arch rests.

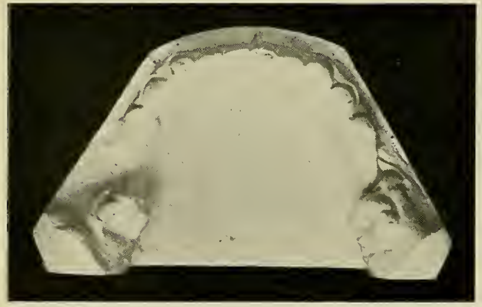


FIG. 9.

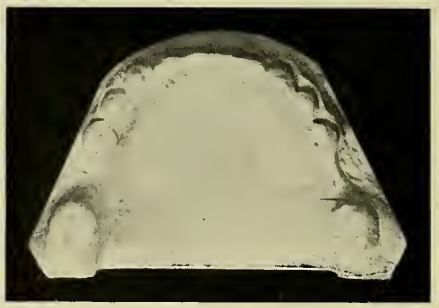


FIG. 10

Solder to the arch a rigid hook so as to pass between the cusps of the cuspid and the first bicuspid, and extend well up toward the palate with the hook pointing mesially (Fig. 8, A and B). From this hook stretch a rubber band over the screw of the clamp band on the molar. At first thought this may seem impracticable, but after looking over the models of several cases, I find that it is very rare that such a hook can not be placed.

In such cases the cuspid on the same side as the molar to be rotated may be banded and have a hook soldered to it, for attachment of the anterior end of the rubber (Fig. 8 C). This necessitates thorough ligation of the banded tooth to the arch in such a way that the cuspid will not be rotated nor displaced in the rotation of the molar.

In Fig. 8 B every unit of force exerted by the rubber band to draw the disto-lingual corner mesially is directed by means of hook and arch to drive the mesio-buccal corner distally, which gives the most reciprocal application of force possible. In Fig. 8 C the force is less reciprocal, owing to the intervening cuspid, but still efficient. There is nothing to interfere with arch adjustment, and no necessity of removing the arch for future bending. If the attachment to the pipe that carries the arch is inclined to slip out of this short tube, it can be prevented by placing a wire ligature around them (Fig. 8 C). In Fig. 8 C is also shown a ball and socket arrangement for attaching the pipe to the band, which may be an improvement in some cases. Fig. 8 C, however, shows the usual method of attachment to the D band.

Fig. 9 shows the lower of a man of nineteen with the first molars lost and the second molars badly rotated. Fig. 10 is the same case, which has been corrected by the use of this appliance, after first tipping the molars back with the usual application of the arch and the D bands.

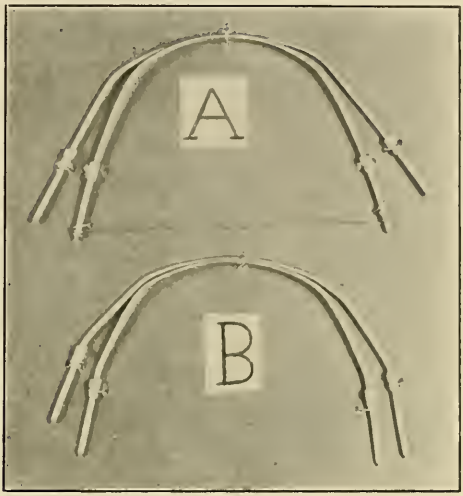


FIG. 11.

I once asked a friend of mine about rotating malposed molars, and he said, "I can rotate them the way I do not want to." This, I think, has been the experience of many of us.

The D bands are usually placed on the first molars with the pipes parallel to the buccal cusps. If some precaution has not been taken, where much expansion is required, the rotation of these molars is sure to follow, and the distal portion of the tooth is always carried further than the mesial (Fig. 5). This is owing to the fact that as the arch returns to its original position carrying these teeth with it, the extreme ends of the arch widen very much more than the parts where the nuts rest (Fig. 11 A). Consequently, if the pipes remain parallel to the buccal cusps, the distal portion must be carried buccally very much more than is required. All that is necessary to prevent this is to put a pronounced bend in the arch just in front of the nuts, so that, as the arch returns to its original position, the distal end of the pipe does not move any more rapidly than the mesial end (Fig. 11 B).

When plates are used for retention, the rotation of these molars is not a serious matter, as they will usually return to their normal position, but when a fixed lingual retainer, as shown by Dr. Lourie at our last meeting, is used, it is of great importance that they should not become rotated. This I have learned from sad experience.

Discussion of Dr. Young's Paper.

Dr. Lourie.

To my mind Dr. Young's paper is on a very timely topic, and I believe he has brought to our attention facts and suggestions well worthy of emphasis and further discussion. The appliance speaks for itself, and it appeals to me as being valuable for the reason that the forces applied to the molar are so completely under control. Furthermore, it leaves the expansion arch free to be used directly on the other teeth. In other words, when the expansion arch is used for the purpose of rotating molars in the usual manner, its usefulness in moving other teeth is much impaired. If the molar needs to be rotated, and the expansion arch is used, the movement of other teeth must be delayed until the molar has been partially rotated, at any rate. I believe it is a good appliance and a valuable one, but I do think the description of it and the time required in describing it detracted from other points in the paper more valuable than the appliance.

I must disagree with Dr. Young when he says that molars in torsion occlusion are not very common where teeth have not been extracted. I believe it is common to find them in patients of ten to twelve years of age where there has been no extraction. For some reason the upper molars especially have been rotated in the manner Dr. Young explained. I think it interferes many times with the proper diagnosis: the buccal cusps are in lingual relation, while the lingual cusp may be normal mesiodistally in its relation to the lower molar.

I have noticed cases on the screen during this meeting in which the first molars were rotated considerably. In those cases it probably made no difference at the time, because the second molars had not erupted; but when the second molars come in we begin to have further trouble; so that those things must receive careful attention. I believe we should pay more attention to the rotation of the first permanent molars.

Dr. Young says if we had the reverse position of the molars in using the expansion arch for rotating (if we were rotating in the opposite direction) it would be a much simpler matter. I would like to ask him why? It seems to me it simply requires a different bending of the arch to use it for that purpose. He says if some precaution has not been taken where much expansion is required, the rotation of these molars is sure to follow, and explains how it may be prevented. I would like to impress on everybody the necessity of preventing these teeth from becoming rotated in the wrong direction. Dr. Young suggests if we put a retainer on that does not hold these molars rigidly, they may return to their original position. That is not always the case. It will prevent many complications if the molars are carefully watched and prevented from rotating during their treatment.

Lingual Arch Retainer.

One more point I want to explain since he has referred to the lingual retainer and used my name in connection with it. I think the lingual arch has been used improperly. No one should think of putting a fixed, rigid retainer on teeth not in their normal positions, nor where he expects them to adjust themselves as a result of occlusal contact. Consequently the molar should not have a rigid arch put on it in the case he cites. If the molar has been rotated, and you wish to allow it to assume its normal position, make a hinged attachment to the molar band instead of a rigid attachment; or transfer the attachment to a bicuspid band. It is the better plan to prevent the molar from rotating at the beginning.

In conclusion I would like to emphasize two points: The fact that molars are frequently rotated even where no extraction has taken place, and the necessity of being more careful in preventing rotation during treatment. I have been surprised at the number of cases reported in the past year or two where fine results were attained in the anterior part of the mouth and yet the molars were much in torsion, having been left so without any explanation.

Dr. Hawley.

I fully agree with Dr. Lourie that many molars are in torsal occlusion where no teeth have been extracted, and I have also noticed many cases where these were left in torsal occlusion. Dr. Young says that men in years gone by, those who have done orthodontia, have left those molars rotated. That is true, but it is now possible to get perfect occlusion. The method shown in this paper is one round in the ladder of advancement.

To anyone of a mechanical turn of mind it seems to me this method of Dr. Young's must appeal. The force is direct and positive; just where we want it. When we get our appliances so perfected that we can apply force where we want it exactly, the movement of teeth is quite easy. In regard to the question of the space taken up by the molars, I think Dr. Young is probably right. I have not had an opportunity of testing the matter.

Dr. Lourie. One other point I meant to bring out. I have frequently heard it said that there are cases in which the upper teeth are larger than the lower: i. e., the upper arch out of proportion to the lower, and in several of those cases I am quite certain the apparent difference is caused by this very thing Dr. Young has explained. The rotation of the upper molar has taken up just that much more room in the upper arch, and it has been difficult to get the upper cuspids and bicuspids back to the normal position with reference to the lower.

Dr. Abell. I have seen that in three different cases. I have not been careful enough in the rotation of molars. I think I can go back home now and get such cases in better shape than I could if I had not attended this meeting. This point has been worth the trip to me, and I have thoroughly enjoyed this paper.

Another point occurs to me. I think in the appliance as shown on the screen you are not getting all the power you might get. If you would remove the German silver threaded bolt and replace with threaded clasp metal, extending it further to the front, say as far as the cuspid, you might do away with the hooks on the arch, as a ligature of wire from the end of this arm to the arch would rotate the molar, as the end of the arm was brought up near the lingual surfaces of the bicuspid and cuspid.

Dr. Stanley. I have discussed the rotating device with Dr. Young privately, and I contend that it is not a reciprocal force which he applies. There are two simple forces operating in the appliances shown—one, the elastic force on the lingual side; the other, the nut on the expansion arch as it is turned back on the arch. I do not think the appliance should be termed reciprocal in its action, because it would be misleading.

Dr. Young. I am sure you have been very complimentary in your remarks—all of you, and I appreciate it. As to Dr. Lourie's remarks: When I said molars are not often found in rotated positions, I meant we do not find them in seventy-five or ninety-five per cent. of the cases in torsal occlusion, but I have noticed in the last three meetings of this society many molars that were in torsal position and were left that way. I said, Why can not they be rotated? and I tried and tried to rotate them. I have not had a great many cases, but have had quite a number of the upper first molars in torsal occlusion. I do say, as I said in my paper, that we almost invariably find those molars rotated after a tooth has been extracted in front of them. I agree with Dr. Lourie's point about these molars being in torsal position interfering with diagnosis. Dr. Lourie also says, Why can not we rotate the molars as easily one way as the other? I think the second part of my paper answers that. Putting the arches in without the little bend made us do what we did not want to do: the kink does the business, I believe.

Another point Dr. Lourie brought out. I did have sense enough when I retained that case with the lingual wire to make some provision for those molars to go back, but they did not go, so I have had to pull them back, and I agree with him that the better way is not to rotate them.

In answer to Dr. Stanley: I have not shown any attachment (Fig. 8 B) at all to the teeth in the arch. Say that this rubber band exerts a force of eight ounces, as Dr. Reoch gave in his paper this morning. It must pull as hard on the hook on the arch as it does where attached to the band on the molar. Now, if the hook is so placed that nothing interferes with it, that force is transferred through the hook and the arch right back, and I contend that every unit of force applied by the rubber band to pull the disto-lingual corner of the tooth mesially, is directed against the other corner to force it distally—which is absolute reciprocal force. On the other side (Fig. 8 C) there is a band on the cuspid, with hook on same. The rubber band is placed over the hook and attached to the molar as in the other case. I do not claim that to be a reciprocal force.

Dr. Stanley. I understood that the expansion arch was to be used and rotation of the molars accomplished simultaneously with the other movements of the teeth. If that is the case you change the reciprocal force which you have just described into two simple forces. I understood that the advantage to be gained by this form of appliance was that it facilitated the rotation of the molars while the other teeth were being moved, and I do not gainsay that point. I merely wish to make the point that if the appliance is used with the expectation that it will act as a reciprocal force, when all the other teeth are tied to the arch, the result will not be what is wanted. The elastics on the lingual side will be the force brought into play, while the attachment of the arch on the buccal side will act as a pivot. To accomplish the rotation of the molar on its long axis it would be necessary to screw the nut back on the expansion arch; therefore, unless the appliance is used solely for the rotation of the molars it can not be termed reciprocal.

Dr. Young. We have christened the baby "absolute reciprocal force" without showing any attachment to other teeth. I still think you can carry on the other tooth movements while using this appliance, but then it might not be absolute reciprocal force.

I wish to thank you for the discussion you have accorded my paper.

THE AMERICAN SOCIETY OF ORTHODONTISTS

Serial
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1907

SEVENTH ANNUAL MEETING HELD AT
DETROIT, MICH., OCTOBER SECOND, THIRD
AND FOURTH, NINETEEN HUNDRED SEVEN

THE AMERICAN SOCIETY OF ORTHODONTISTS

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DETROIT, MICH., OCTOBER SECOND, THIRD
AND FOURTH, NINETEEN HUNDRED SEVEN

Dates and Places of Meetings

of

The American Society of Orthodontists

First annual meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second annual meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third annual meeting held at Buffalo, N. Y., December 31, 1903, January 1 and 2, 1904.

Fourth annual meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth annual meeting held at Chicago, Ill., September 29, 30, and October 1, 1905.

Sixth annual meeting held at New York City, December 27, 28 and 29, 1906.

Seventh annual meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Table of Contents

President's Address

Dr. Herbert A. Pullen 3

Cements—Their Use in Orthodontia

Dr. W. V-B. Ames 28

The Genesis of the Blood Supply to the Teeth

I. Norman Broomell, D.D.S. 37

The Influence of Nasal Obstruction and Mouth Breathing Upon the Development of the Face, Palate, Teeth and Chest

Henry J. Hartz, M.D. 57

Double Resection for the Treatment of Mandibular Protrusion

Max Ballin, M.D. 75

A Contribution to the Knowledge of the Etiology and Treatment of Cases in Class II

Rodrigues Ottolengui, M.D.S., LL.D. 85

Some Observations on the Tempo-Maxillary Articulation in Changing the Occlusion

Dr. Henry A. Baker 104

Early Treatment in the Correction of Malocclusion of the Teeth

D. Willard Flint, D.D.S. 114

What Can Oral Prophylaxis and Orthodontia Do for Each Other?

N. S. Hoff, D.D.S. 130

Transactions
OF THE
American Society *of* Orthodontists

SEVENTH ANNUAL MEETING

Held in Detroit, Mich., Oct. 2, 3, and 4, 1907

President's Address

By Dr. Herbert A. Pullen, Buffalo, N. Y.

Mr. President, and members of the American Society of Orthodontists:

Analysis and synthesis are two words of frequent use in science, and although one is almost the antithesis of the other, analysis meaning to break down structures, to discover their unit composition, and synthesis to build up a structure from a unification of unit components, their inter-relation is such that science could not dispense with one without serious consequences.

The microscope is analytical, enabling the histologist to discover the unit of tissue structure, and text-books on anatomy have had to be re-written to harmonize the synthetic construction of the science of human morphological structure to its analytical cellular structure.

Physiology and pathology have alike been compelled to rearrange their synthetical treatises in accordance with an analytical study of cellular life.

Why this reconstruction, why the years of unremitting toil, the one with the microscope, the other with the naked eye, uniting in their endeavors and finding a harmony in the work of each other? It is because beneath it all is the truth, which in science, as well as in theology, contains the greatest good for the greatest number, because of the benefit to mankind, the spirit of true helpfulness being uppermost.

But strange as it may seem, the man with the microscope, and the theologian with his discussion of the higher criticism, sometimes becomes so absorbed in his task of picking things to pieces that he neglects to put them together again; he is accustomed to working at a tangent to the sphere of universal usefulness, and soon the world loses sight of him, even as he has lost sight of the truth shining at his elbow, which he has forgotten to but give a turn of his head to see.

This is a scientific age, and the breaking down and building up processes are going on in every art.

Human knowledge is a wonderful thing in its varied comprehension of the universe, of the trivial or important events, which go to make up history, art, literature, science, religion and philosophy.

Arthur James Balfour, the famous Conservative politician and writer, has most concisely and clearly described the fundamental and evolutionary principles of knowledge in a work entitled, "The Foundations of Belief," which he wrote "for the general body of interested readers, rather than for the specialist in philosophy," his object being "to recommend a particular way of looking at the world problems, which, whether we like it or not, we are compelled to face. I wish to lead the reader to a point of view whence the small fragments of the infinite whole may appear to us in their true relative proportions."

He says, "Assuming that knowledge exists, we can hardly do otherwise than make the further assumption that it has grown and must yet further grow. In what manner, then, has this growth been accomplished? What are the external signs of its successive stages, the marks of its gradual evolution? One, at least, must strike all who have surveyed, even with a careless eye, the course of human speculation—I mean the recurring process by which the explanations of explanatory formulas in terms of which mankind endeavor to comprehend the universe are formed, are shattered, and then in some new shape are formed again.

"It is not, as we sometimes represent it, by the steady addition of tier to tier that the fabric of knowledge uprises from its foundation. It is not by the mere accumulation of material, nor even by a plant-like development, that our beliefs grow less inadequate to the truths which they strive to represent. Rather are we like one who is perpetually engaged in altering some ancient dwelling in order to satisfy new-born needs. The ground plan of it is being perpetually modified. We build here; we pull down there. One part is kept in repair, another part is suffered to decay. And even those portions of the structure which may in themselves appear quite unchanged, stand in such new relations to the rest, and are put to such different uses, that they would scarce be recognized by their original designers."

Applying this truth to our own searching for knowledge in our society work, does not the similarity of the conditions prevalent here with the general conditions in the building up of knowledge which the quotation describes, appeal to you?

Here we have represented an art and a science, which for fifty years has been built upon the sand. To-day things appear to us in a different light, the old structure is overthrown, and we attempt to build upon the solid rock of truth, only to find ourselves unproficient in the adaptation of our art to new conditions. There is the old foundation, the sand is easy for our feet, the rock is hard and forbidding. But even as we are becoming discouraged our neighbor, who has built upon the rock, comes to our assistance, and with helping hand and kindly word aids us in the new construction, whereby we once more assume the courage of confidence and the rewards of ability.

A Tribute to the Old School.

The attitude of this society toward the "old school," as it has been ungraciously styled, should be, and is, one of admiration and respect for their achievements in the past, and to all those of the older orthodontists who possess the requisite qualifications, we extend a hearty invitation to join our ranks, promising them that they will not be ostracised, but given the seats of honor, in recognition of their efforts to build up the science.

At the coronation of King Edward the military pageant included the troops from every quarter of the globe—the white troopers of the United Kingdom, the tall and brawny Scotch Highlander, the strong and rugged Canadians, the brown soldiers from far away India, and the black troops from Africa.

Coats and faces of varying colors were there represented, but they were all there for one purpose, to crown their king.

It did not mean that each regiment was not interested in its own country, its politics and its resources, nor that the Scotch Highlander did not enjoy the secret belief that the style of his trousers was much to be preferred to those of the Johnnie in the Queen's Own, but it did mean that upon one thing they were united, the love of their monarch, and to do him homage.

What matters it how varied, how crude, or how cultivated are our ideas as long as we are working for a common end, the advancement of our science and the betterment of our practice?

Orthodontia as a progressive science has been, and is, going through the analytical and synthetical stages of modern reconstruction.

An analytical study of the science, from the standpoint of the laws of occlusion, articulation and development to-day has shifted the abiding place of progress from the mechanic to the diagnostician, from the empiric to the scientist; to-morrow, the mechanic and the empiric may again wear its mantle.

The reconstructive period of the Civil War was a difficult one for the statesmen of this country, but the North and the South were alike remembered in the efforts to restore harmony.

The period of reconstruction is now upon us, and the profession is looking to the American Society of Orthodontists, and similar societies, with a questioning eye. Will they give us the truth, will they be generous in their reconstruction of our old ideas of extraction, and diagnosis, and treatment from symptoms? Will they annihilate us if we dare to mention that we have done all our regulating with jackscrews, and still use them because we had not learned of anything better for the purpose?

Is a lifetime of devotion to the science, even though it be not adjusted to the modern view-point, to be violently thrust to earth, as of minor consequence?

If so, it is time that we laid aside our microscopes and look through the clear, human and common sense eyes given us by our Creator, see things in a natural light, and extend the right hand of fellowship and good will to our confreres, who may have been in some unknown way the foundation of our success.

Orthodontia is not an easy science. No human being yet has entirely mastered it. We would not be here to-day for interchange of thought if the vagaries and complications of diagnosis and treatment were not still punctuated with question marks in certain places in our minds.

Ever since the organization of the American Society of Orthodontists, I have been impressed, not only with the grandeur of its purpose and the earnestness of its members, but more than all that, with the broadness of its scope, as indicated by its name, American.

It is national in character, as is every other organization bearing this name, and as such, is open to membership to anyone possessing the requisite qualifications in this country.

Our constitution and by-laws dare not prohibit membership to anyone because his ideas may differ from those of the majority, or because he may have a hobby. One need not necessarily master the laws of occlusion to become a member.

Although we as a body represent the "new school of orthodontia," it simply means that we recognize certain principles of progress which the other fellow has not had time nor opportunity to digest. To feed him on the left-overs is not going to aid his digestion nor build up his leanness of knowledge on the subject.

This society has much to be proud of in the work it has performed in the last six years, not only in the quality of its papers, its widespread influence, and in the advancement of orthodontia as a distinct specialty, but also in an awakening of the medical profession to a realization of the possibilities of orthodontia, especially the rhinologists, with whom the orthodontist comes into daily contact through reference of patients.

The very high degree of operative skill required to obtain results in treatment, such as have been exhibited by the members of this society, is a great credit to the organization, and shows an earnestness of purpose, and a zealous enthusiasm which exhibit an entire lack of pecuniary motive in its fulfillment.

The activity of its members in foreign countries has given birth to the European Orthodontia Society, the president of which is a member of this society.

Were I to make any suggestions at this time, they could only be along the general trend of thought and practice, the latest and best of which is annually presented to this society in its papers and clinics. Unlimited fields of research in orthodontia, and adjoining fields of knowledge bearing thereon, stretch out before the imagination of all of us, replete with grand and splendid possibilities.

There is always something of interest to present, or to be presented; there is always something new to be investigated at these meetings which will suffice to fill the programmes of future meetings ad infinitum.

New laws, new theories, new methods will come and go, and some will stay, for the good of the cause.

Francis Bacon says of innovations, "It is true that what is settled by custom, though it be not good, yet at least it is fit; and those things which have long gone together are, as it were, confederate within themselves; whereas new things piece not so well, but though they help by their utility, yet they trouble by their inconformity. This would be true if time stood still, which, contrariwise, moveth so round that a forward retention of custom is as turbulent a thing as an innovation; and they that reverence too much old things are but a scorn to the new. It were good, therefore, that men, in their innovations, would follow the example of time itself, which, indeed, innovateth greatly, but quietly and by degrees, scarce to be perceived. And, lastly, that the novelty, though it be not rejected, yet be held for a suspect, and, as the Scripture saith, that we make a stand upon the ancient way ,and then look about us, that we discover what is the straight and right way, and so to walk in it."

Comparative Value of Materials for Construction of Appliances.

And now to come to a very practical subject, the comparative value of materials for appliance construction. I wish to bring this up for general discussion, by the advancement of a few ideas, which may or may not be held in common by the majority of the members of the society, certain salient features of which I hope to be able to prove for the benefit of orthodontia of the future, and which will tend to further its progress and raise its standard.

I refer to the use of gold and platinum and their alloys for the construction of appliances as preferred to German silver.

That we may have a clear idea of the status of German silver as a material for appliances in orthodontia, I will quote the following paragraphs from the latest text books on orthodontia:

Dr. Guilford says concerning German silver:

German Silver.

"This improperly named alloy, composed of copper, zinc and nickel, is frequently employed in the construction of regulating appliances, on account of its stiffness and inexpensiveness.

"While it may be regarded as a base compound, its baseness is of so high a grade that it may be used without fear of harm to the soft tissues or the general system.

"Professors Angle, Matteson and Jackson use it very largely in the construction of their appliances, and the author has made frequent use of it without ever noticing any deleterious effects."

Dr. Jackson says, speaking of the material for the construction of the partial clasps in his system: "Platinoid and German silver have been used extensively for this purpose, and have their advantages where soft solder is used, but preference is generally given to the precious metals, as they are less liable to oxidize.

"The spring clasp is made of any suitable metal, usually of spring gold, German silver, or platinoid (piano wire has been employed)."

Dr. E. H. Angle, in the 1907 edition of his work, has to say:

"Gold, silver, platinum, platinum gold, platinoid (so called), aluminum, and several of the baser metals and alloys, as brass, copper, aluminum, bronze, steel and iron, and also vulcanized rubber, may all be used in the construction of regulating appliances, and each possesses properties of more or less value; yet, after experimenting with all these, the author is thoroughly convinced that the material most nearly filling all requirements is nickel silver.

"Since its introduction for the manufacture of regulating appliances by the author some twenty years ago, it has largely supplanted all other metals for this purpose.

"The wearing of bands of this metal for three consecutive years, without detrimental change, has been noted by the author. In a small percentage of mouths, however, it is true that it does become discolored even to unsightliness.

"This fact has given rise to the only prejudice against the use of this metal that we know of, but this objection seems trivial in view of its many points of superiority. And, lastly, its inexpensiveness brings it again into sharp contrast with gold and platinum; yet we insist that it is its excellent qualities more than its inexpensiveness that makes it so preferable a metal for orthodontic purposes."

"The oft repeated fallacy that gold is the one suitable metal for the construction of regulating appliances is rapidly passing, as it ought, for undoubtedly it has been a real hindrance to progress."

Gentlemen, is it an accepted fact that the use of gold in the mouth is a real hindrance to progress?

Has the experience of the orthodontist of the last twenty years been such as to leave nothing further to be desired than German silver as a material for appliances?

Does German silver possess qualities such as strength, spring, high fusing point, malleability, hardness and softness, and greater rigidity in thin plate form, such as is used for molar clamp bands, than can be obtained in some of the noble metals?

It might be argued that the fact that all regulating appliances on the market are manufactured of German silver is sufficient answer to my question. I am willing to let this argument stand on its merits, without questioning the motive of the manufacturer.

We will say that the idea of the manufacturer is simply to supply an existing demand for German silver appliances in the profession, without any attempt to force it upon them by claims of superiority over gold or platinum.

Therefore, with these premises, is the field now open for original research along this line, and surely our minds are open to conviction.

A few years ago, in speaking of the wide range of qualities possessed by German silver to a goldsmith, he said to me: "Gold is a metal capable of alloying in so many different ways that it is possible to at least duplicate, if not excel, any of the qualities possessed by the alloy of German silver."

Since that time I have proven to my own satisfaction the truth of this statement, and from the results obtained by scientific experimentation, there is every reason to believe that the use of gold and platinum alloys for appliance construction will be the next advance in practice in orthodontia.

If it can be demonstrated that gold and platinum are more desirable for appliance construction than German silver, regardless of expense, should not this society be foremost in proclaiming it?

Alas, we are too late. Already a dental society of New York has the precedence in this respect, but there are further honors to be sought for in the adoption of the noble metals in the practice of the specialist and in the influence of his practice upon the profession in general.

It is time that this society took up this matter in earnest if they do not wish other societies to win away their laurels.

It is worthy of note that the foreign orthodontists who exhibited appliances at the International Dental Congress at St. Louis, in 1904, displayed *only gold appliances,* all American appliances being made of German silver.

Comparative Qualities of Metals.

Let us examine somewhat closely, the comparative properties of gold and German silver in detail, in order that we may make logical conclusions concerning them.

To begin with, gold and platinum do not oxidize; German silver oxidizes in the air and in the mouth.

Pure gold and pure platinum are unaffected in color by heat; German silver oxidizes with sufficient heat.

Perhaps one of the most important properties possessed by platinum and gold alloy is that of retaining elasticity and hardness after heating to redness.

German silver becomes annealed in this process, losing elasticity and hardness, and rendering it unfit for use as expansion arches.

The expansion arch in a gold and platinum alloy can have hard, soldered attachments, such as hooks and spurs, without interfering with its temper and elasticity.

Attempting hard soldering to a German silver arch is to destroy the temper without which it is unfit for use in expansion.

The chemical reaction to acids and alkalies for gold and platinum alloys is zero, except for aqua regia.

German silver is acted upon by most of the strong acids and alkalies, such as H_2SO_4, HNO_3, HCL, etc., and by such weaker acids as acetic, Iodin attacks it vigorously. H_2O_2; 3 per cent. even, attacks it.

Potassium sulfocyanate, which is normally present in the saliva, and which it is thought renders the teeth immune to caries when present in sufficient quantity, very badly discolors it.

Platinum.

Pure platinum wire, and a wire consisting of an alloy of gold and silver, possess the softness and pliability of the annealed German silver wire with a low percentage of nickel, which is commonly used for retaining wire.

When a specially stiff wire is required for retention, iridio-platinum cannot be excelled in this quality by any other alloy, and for this purpose can often be used in as small a gauge wire as No. 19 Brown and Sharpe, a grade which the writer prefers for retention of deciduous arches in the shape of the lingual arch wire, and for labial spurs upon incisors and cuspids, as offering every advantage of efficiency, durability and esthetics.

Iridio-Platinum.

Platinum and iridium alloys are less fusible, harder, more elastic, specifically heavier, and less readily attacked by aqua regia than platinum, these qualities increasing as the percentage of iridium increases.

The ten per cent. alloy of platinum and iridium is claimed to be superior to any other solid as a material for standard measures of length and weight.

The International Metric Committee adopted this alloy for the construction of their standards when they met in Paris several years ago.

Gold.

Gold is the most malleable of all the metals. Its hardness varies with its composition, and for purposes of appliance construction should be so alloyed that its fusing point will not be appreciably lowered, as with platinum, and for the specific purpose intended; *e. g.*, the expansion arch should be hard and elastic; tubes upon molar bands hard enough to resist the force of mastication, but not requiring the elasticity of the expansion arch. Nuts should be comparatively higher in carat of gold so as to render them easier to be threaded.

Gold unites with platinum in all proportions, forming grayish-yellow or grayish-white alloys.

The tenacity of gold is very greatly increased by admixture of platinum, while at the same time it is rendered more elastic.

For the parts of the molar clamp band, and the expansion arch, an alloy of gold and platinum is to be preferred to any other alloy of gold, principally because of the high fusing point of this combination, and therefore less liability to fusion in the blowpipe flame.

An alloy of gold, silver and copper, in the tube of the molar clamp band would be liable to partial fusion at least in the blowpipe flame during soldering operations, while the same tube in a platinous gold would be infusible in the ordinary blowpipe flame.

The fusing point of platinum is 1775 degrees Centigrade, of gold 1075 degrees Centigrade. An alloy composed of 90 per cent. gold and 10 per cent. platinum, fuses at a temperature of 1130 degrees Centigrade, which is very significant, proving to us that *pure gold* may be used as a *solder* upon this alloy without danger of fusing the alloy, since the fusing point of the alloy is 55 degrees higher than the fusing point of gold.

The samples of wire and plate which are being exhibited are German silver and gold, and platinum alloys, of varying degrees of hardness and softness, elasticity, etc., from the piece of soft German silver wire, and its equally soft counterparts in the noble metals, the gold and silver alloy and the pure platinum, to the hard and elastic gold and platinum alloys for expansion arches and traction screws, and the still stiffer iridio-platinum wire for retention.

By comparing these wires and plates, it will be observed that there is nothing left to be desired as far as gradation of elastic qualities is concerned in the gold and platinum alloys.

Three sizes of arches in gold and platinum and the molar clamp in gold and iridio-platinum are exhibited on another card.

The iridio-platinum plate exhibited on the same card has plenty of edge strength in gauges even thinner than No. 36 B. and S. gauge for molar clamp bands, and for plain bands can be used as thin as No. 39 B. and S. with success.

Pure platinum for retaining bands is often of service, especially for the deciduous teeth.

The gold alloys in plate shown on the card are also of value in plain bands, and for retention bands where preferred for various reasons.

Gold and platinum are both more pliable than German silver, and can be more accurately burnished and adapted to tooth surfaces.

Objections to German Silver.

After ten years' use of German silver, even triple plated with gold, I can honestly say that I am disappointed in it as an ideal material for the construction of appliances and for several reasons.

In the first place, we will suppose that the only objection to its use is its "discoloration even to unsightliness," and ask the question, "Is this a frequent occurrence?" and if so, is it serious enough to warrant the use of gold and platinum in its stead?

I do not hesitate to declare that in at least seventy-five per cent. of our cases German silver will discolor to the state of unsightliness, and in my opinion this alone is enough of a disadvantage to condemn it as an ideal material for the purpose used.

How many times is the request made by our patients that the arches and bands be repolished, the patient often believing that the gilded surface is restored by repolishing.

How many of them also believe that the material of which their appliances are constructed is gold, and with what embarrassment the acknowledgment is forced from us that it is German silver gold plated, and that the plating is slightly worn off.

A retaining band of German silver was removed from one of the writer's patients some years ago, and sent to the assay office at Washington to be melted up for the gold it contained, and the surprise of the people when the report of the assay office came in brought forth a letter of inquiry regarding the matter, which was at least embarrassing.

In a very careful examination of German silver appliances in the mouths of my own patients for a number of years. I have found that *discoloration* is not the worst objection to their use, a large percentage of them showing surface corrosion, indicating chemical action to a greater or lesser extent.

I will pass around three specimens from three different mouths for your inspection with the magnifying glass.

The surfaces of these bands are not only corroded, but the entire thickness of the band is perforated by the destructive action of the fluids of the mouth.

The pits formed in the surface of the arches, bands and tubes, afford lodgment and breeding places for bacteria, which are impossible to remove with all the hygienic care possible.

In regard to the actual chemical reactions which take place during these corrosions, I am unable at present to state any facts. This will remain for future experimental work or analysis by the chemist. There is no doubt, however, that the acid or alkaline reactions in the mouth at various times are sufficiently strong to produce such corrosions, inasmuch as German silver is not impervious to the attacks of almost any of them.

One authority declares that German silver becomes coated with a coat of verdigris when placed in vinegar, a poisonous combination of the basic acetates of copper being formed.

Vinegar is often used with the food as a relish in sufficient quantity so that appliances could be affected.

But suppose that these acetates and oxids which form are not detrimental to health, as would seem evident only from lack of statistics on this point, and that all bands are cemented upon teeth, so that food can not collect underneath them and be a medium for the growth of harmful bacteria to the enamel. Is there any possible deleterious action through the wearing of German silver appliances? Yes, there is one more, serious enough to warrant its discontinuance, and that is the deep metallic stain to the enamel surfaces of the teeth where the arch rests upon them, below and above the edges of all bands, and upon the interproximal surfaces of teeth which are ligated with brass ligatures.

This stain is so deep and of such composition that the strongest bleaching agents which can be used in the mouth with impunity fail to entirely remove it.

Or, again, when the stain appears to be removed, the enamel itself is seen to be injured in a manner similar to the white decay often seen upon children's teeth.

Noble Metals Recommended.

Prophylaxis demands more of us to-day than it did twenty years ago. Hygiene of the mouth is a subject that is taking up the efforts of the best minds in the profession toward the establishment of a higher and better standard.

The adoption of the all-gold appliance belongs to the same advance in practice that sterilization of instruments and oral prophylaxis have already set the standard, and to their edicts the dentist of the twentieth century must conform.

I do not claim to be the first investigator into the possibilities of gold and platinum for appliance construction. Other members of the society have been working faithfully and with good results along the same line.

One of the members of this society told me that he used nothing but gold and platinum in the mouth, that the cost was a minor consideration in view of the fact that the cost of the material in a molar clamp band in gold was no more than the price of the same article in German silver.

I happened in to the office of another member of the society and he showed me a mammoth sheet of iridio-platinum worth in the neighborhood of $150. On inquiry, I learned that he intended to start in with the use of the noble metals for his appliances.

I must insist that the expense of the all-gold appliance is not to be considered in view of its many other advantages. For a small consideration the gold appliances may be remelted and made over into wire or plate for use again as arches or bands, to say nothing of its money value as scrap, which in the long run will prove rather more of a profitable investment than an expenditure.

The all-gold appliance has come to stay, and it only remains for the appliance manufacturers to fall into line with a demand which will soon prevail universally for the advancement of the standard of orthodontia and the benefit of humanity.

Many of you have been using gold and platinum alloys for retaining appliances for some years with great satisfaction. Does it not behoove you to get a step farther and adopt the all-gold standard for the entire apparatus?

Looking ahead into the near future, I can see the foremost specialists in the country reaping the rewards of this advance step in the giving of better service to the patient, and receiving better pecuniary compensation therefor, as well as the satisfaction that there is nothing left undone in the furtherance of his art which science teaches is of practical and enduring value.

I can prophesy also a worldwide controversy over this subject somewhat similar to the gold vs. amalgam, and gold vs. vulcanite controversies, which aroused so much discussion in the dental profession at different periods of its history, but with this difference, and that is, while these other questions have never been fully decided one way or the other, there could only be one answer to the question, "Which is the most preferable and practical metal for the construction of regulating appliances, the noble or the base metal?" and that answer will be *gold*.

Discussion.

Dr. J. Lowe Young. I have listened to the address of our president with much interest, and what little I will have to say will be along the line of gold and platinum vs. German silver in the construction of appliances.

It occurred to me first when in St. Louis that our appliances were not properly constructed with regard to size, and that started me on the idea of having them made a little different from those on the market. Then the question came as to a proper metal, and I talked with several about the use of precious metals in the construction of these appliances, and all with whom I conversed said: "You can not get anything to take the place of German silver for the expansion arch."

I happened to run across a man who was formerly in the jewelry business, who wanted to put his boy in my care for treatment. He said, "I will tell you one thing, you must not use any German silver in his mouth!" I said, "Then I won't treat your boy, because I have nothing to take its place." He replied, "Why not try spring gold?" I said, "I believe there is none of that material prepared that will serve the purpose," whereupon he asked if he might not make me some. He did, and I found it to be much better than the best German silver I ever had used. It is a little brittle, however. But it will retain its spring indefinitely when used in the mouth. You will all concede that the German silver expansion arch loses its spring materially.

I would no more think of using German silver clamp bands for retention than I would tin.

I think we have much to learn yet as to the gold appliances. The nuts on those I have used have not been entirely satisfactory. The threads of the screw and nut strip, particularly on the clamp bands. I have had no trouble with the arches. Of course, you do not need to use the force on the nut and screw of this arch that we do on the clamp bands. For the band material I think coin gold will be as satisfactory as anything. Of the same thickness as the German silver it will be strong enough for clamp bands, and will not deteriorate in the mouth.

I will say one thing—not wishing to be too enthusiastic with reference to the use of these precious metal appliances—I have had one case where there was a very marked action on the enamel of the anterior teeth, upper and lower, under precious metal arches. The patient came to see me once a week, and always after leaving my office she went to her dentist, who treated her mouth hygienically, and yet to my surprise after I removed the arches the enamel was found to be quite badly eroded on all the upper and lower labial teeth.

Dr. Ottolengui. How long had treatment lasted?

Dr. Young. Four or five months. The brother came at the same time as the sister, and in his case there was no difficulty. This is the only case where I have noted this trouble under precious metal. She was an extremely nervous patient, and I could not change more than one ligature at a sitting usually.

Dr. Pullen. I wish to pass around an all-gold retaining appliance made by Dr. Baker a number of years ago. It presents some very valuable points.

Dr. Lloyd S. Lourie. I wish before discussing the precious metal question to commend the first part of our president's address in which he refers to the period of transition we are passing through, changing from the old to new methods, and without attempting to enlarge upon his nicely worded simile, I would emphasize the point that there is a necessity for a great deal of tolerance and charity for other people's ideas. I will not attempt to say anything further in this direction, because Dr. Pullen expressed his thoughts so well.

The Doctor is right about the use of precious metals for appliances, and, as Dr. Young has suggested, the objections to using German silver for clamp bands. I think his experience with some of my clamp bands (especially when I used the clamp bands for occlusal spurs) may have confirmed his objections. You can not get enough reinforcing solder in between the teeth to prevent their breaking. Since then I have been using iridio-platinum for clamp bands, as well as for plain bands for moving and retaining teeth. The latter I have thus used for five years.

Effect of Metallic Oxids.

I have often wondered what effect the dissolving of German silver in the mouth might have on the system in general. The metallic oxids or salts are going into the system, and while there is no record of any bad effects the question has occurred to me whether there might not be some such bad effect that we do not know about. In contrast to this, however, we seem to have a beneficial local effect from the oxidation of German silver. As Dr. Young mentioned softening of the enamel under the gold arch, we may contrast that with the effect of wearing the German silver arches for longer periods, with no softening of the enamel. Perhaps the copper salts have some bactericidal influence in preventing decay. Dr. Harlan has recently called our attention to copper as a germicidal agent.

In general I believe, with proper prophylactic precautions, the precious metals are much preferable. German silver is objectionable from its discoloration.

Advantages of Iridio-Platinum.

To my mind iridio-platinum is better than gold, as gold will tarnish in many mouths when sufficiently alloyed to produce the requisite spring. Therefore, I prefer the iridio-platinum, even for the arches. If we could get a little greater percentage of iridium it might be used exclusively for expansion arches.

Another reason why I have used iridio-platinum almost exclusively for plain bands is that it is not necessary to be as careful in soldering. Then, too, the German silver band must be boiled in acid and polished; the platinum band is immediately ready to put on. Again, you can slip it off and replace it for retaining appliances. The German silver band will soon be corroded and weakened so as to be unavailable for further use. Another point, the German silver arch corrodes to such an extent as to form a rough lodging surface for bacteria, and not only can it not be kept clean and the mouth kept in good condition, but it forms a lodgment and starting point for decay upon the adjoining teeth. So I think, all points considered, the precious metals are better, and I prefer iridio-platinum to gold.

Of course, it is hardly fair at this time to say that German silver should not be used, as undoubtedly in many mouths it keeps as good a color as gold or iridio-platinum, but we can not determine beforehand which mouths will affect the metal, so we would better use the precious metals. The difference in expense, when we consider the scrap value of the appliances, is so little that it ought not to be considered.

None of us can take credit for first advocating the use of precious metals for appliances, as I remember in the last issue of the *International Dental Journal* Dr. Trueman showed a great heap of orthodontia appliances used by Dr. Farrar, and they were all made of gold. Regulating appliances made of gold have undoubtedly been used for many years. But it is just as well to bring out their advantages so they may be used more generally.

Dr. Ottolengui.

I will say a few words with reference to the subject, because I have used the precious metals in the regulation of teeth more than I have used German silver, and those who may think of giving up the use of one for the other may be interested in my experiences.

The arguments against German silver are, first, that by corrosion in the mouth the fixture itself is lessened in bulk and thus weakened; second, discoloration of the teeth; and, third, the fixture itself may become discolored.

The first accusation against the German silver is the principle count, I think, because similar dissolution does not occur with the noble metals. So I will pass that. I think the stripping of the threads on gold appliances can be overcome by having the threads cut deeper. In fixtures that I learned from Dr. Kingsley to make from cleft palate cases, we depend on threaded wire and nut to hold the rubber to the metallic part, and we never had any trouble with either the thread on the wire (iridio-platinum) or the thread of the nut, which is made of clasp metal. It may be a good idea to make the screw of the clamp band of iridio-platinum and the nut of clasp gold.

Discoloration of Metals in the Mouth.

Now about discoloration of the metals. There is no doubt that you do get a good deal of discoloration in German silver appliances from corrosion of the metal, and you get the same, to a proportional extent, in gold that has an alloy in it; but there is another reason for the discoloration—it is a deposition from the mouth itself. In some mouths you can not keep German silver clean, and the peculiar, dark, metal-like stains can not be removed from the teeth without the assistance of pumice stone. Yet, last year I used the Angle appliances, gold plated, in the mouth of one little girl whom I only saw once a week, and not even the gold plating was removed. The appliances were clean, bright and beautiful during the entire period. In another case, where I used gold appliances and saw the patient twice a week, I cleansed once a week for the removal of stains. There was a deposit on the appliances from the mouth itself.

Influence of Contact.

I do not want it to go out that there was any real relation in Dr. Young's case, between the erosion and the use of the gold arch. I do not believe there would have been any less erosion if German silver had been used. It was the result of the metallic arch not being removed for four months. It might have been stained besides if there had been present a metallic oxid, as from the German silver.

It is an old accusation against prosthetic dentistry that clasps ruin teeth. Bonwill pointed out many years ago that you could get as good use out of the clasp if it touched the tooth in three places as if it touched it all round, and claimed less chance for caries. The less points of contact you have in the appliances the better; a tooth which has been rotated needs to be held at only one point to retain it. Many apparently ill-fitting retention devices would be better for the teeth if scientifically applied so that the contact is at the point where needed and not throughout the entire structure.

There is more in this problem of the deleterious effect than the mere physical composition of the appliances. I think the one fact that the noble metals are apparently cleaner in many mouths, and therefore look better (because the discoloration is largely due to the oxidation), makes them preferable, but the principal point I believe is that they are stronger.

Dr. Abell.

I have been looking for something better than German silver for bands in the mouth, and a few months age I began using aluminum bronze for molar bands, and I find that while it is a heavy oxidizer under heat and has a low melting point, yet when annealed it is as soft as gold and permits of ready burnishing and does not corrode in the mouth.

I have used retaining appliances with the lingual arch attached to the molar bands, one molar band of German silver and the other of aluminum bronze; the latter would invariably come out of the mouth much cleaner than the German silver, which was frequently almost perforated. This aluminum bronze will take a gold plate and keep it. What value it would have for Magill bands I do not know. I use it 8-1000 inch for molar bands, and have rolled some down to 7-2000 or 4-1000 for Magill bands, and am just commencing to test it now. This material is ten per cent. aluminum. For soldering, 14 k. gold solder is used.

Dr. Ottolengui. I would like to agree with Dr. Pullen in his suggestion that iridio-platinum appliances may be soldered with pure gold. That is something that Kingsley always did. Pure gold is stronger than solder, because it lacks brittleness. In its ductility you have added strength. The nearer you get to the melting point of the metal you are trying to solder the more thoroughly the solder will become incorporated with its surface.

Dr. Casto. I agree with Dr. Ottolengui as to the point he just made against the uniting of iridio-platinum with a low karat solder. I have had some trouble with the bands parting at the union when a low karat solder had been used, that is an 18 k. solder.

I enjoyed Dr. Pullen's address very much indeed, and wish to commend him for the beautiful manner of his introduction, as well as for bringing the subject of gold and platinum appliances before the society at this time. He informed me several months ago of his intention and I expected that he would be a little more radical than he has been. The subject was presented conservatively and scientifically. We always get something good from Pullen.

Regarding the qualities of the metals, it seems almost ridiculous to compare the qualities of German silver to those of the noble metals, the latter being far superior in every way.

I am inclined to believe that German silver has been used to a great extent because of its being less expensive than the noble metal.

The use of German silver for plain bands has been more expensive in my hands than the use of iridio-platinum. The German silver is more difficult to manipulate. It is much easier for me to fit and solder an iridio-platinum band than it is to fit and solder a German silver band.

After soldering an iridio-platinum band, it is practically finished, as it needs no polishing except where the band has been cut from the ribbon. It requires considerable time to clean and polish a German silver band after it has been soldered. The saving in time alone renders the use of iridio-platinum less expensive than the German silver.

Another important consideration in the use of iridio-platinum is the soldering of lugs or hooks upon the bands. If the joint has been soldered with pure gold, lugs and hooks may be attached with impunity so far as unsoldering the joint is concerned. With German silver it is quite different; unless great care is taken when lugs or hooks are soldered to German silver bands, the joint will open or the material will burn. There is special danger of this occurring when the hook is soldered on the labial surface over the joint for the use of intermaxillary ligatures.

About four years ago Dr. Lourie called my attention to the use of iridio-platinum for plain bands, since which time I have almost invariably used it. For retention, I use iridio-platinum and clasp wire. I do not know the exact percentage of iridium in the iridio-platinum band material. The manufacturers claim about ten per cent. iridium. I have found considerable difference in the working of the material from the different manufacturers.

The action of the fluids of the mouth upon the iridio-platinum versus German silver has been thoroughly discussed.

Dr. Kemple.

I would like to ask Dr. Pullen what grade of hard solder he uses in soldering attachments to the platinum and gold expansion arch without affecting the temper or elasticity of the arch. My experience has been that in using hard solder on the platinum and gold expansion arch you anneal the arch to varying degrees, depending on the grade of solder you use.

German Silver a Preventive of Caries.

In regard to German silver or nickel silver appliances, compared with the appliances made of the noble metals, German silver has been getting a black eye here this morning. I believe there is a soul of good in all things evil, and whatever the chemical action or causes may be, there is less tendency for teeth to decay when in contact with German silver or nickel silver than there is when those teeth are in contact with the noble metals. A few years ago the great majority of clamp bands that were used on the teeth by many orthodontists, were simply clamped on the teeth and left there for months without the precaution of using cement, and little or no disintegration of the enamel resulted. Unfortunately this is not the case if gold appliances are used in the same manner.

I have seen the disintegration of the enamel under gold and platinum expansion arches, and have never seen disintegration under the German silver expansion arches. In using the noble metals for regulating appliances, I feel the necessity of removing the arch more frequently for cleansing, than if that arch were made of German silver. The cause of this difference we do not know. What the chemical actions in the mouth may be, or what the electrical condition may be, we do not know;

but the fact remains that in hundreds of cases where German silver bands have been clamped to the teeth, there has been no decay. I have one case in which I used a gold clamp band and left it for a comparatively short time, and there was disintegration of the enamel. There are several men present who can verify my statement with reference to the freedom from decay under German silver bands.

I use the gold appliances. I believe they have more desirable properties than the German silver, but I feel the necessity of watching the teeth more closely with gold appliances in the mouth than I do with German silver in use.

Dr. Abell. Speaking of erosion occurring under appliances. I would ask if you have ever found any trouble when a spur was thrown over on the enamel of a tooth? I would suggest that you make all spurs knife-edged or pointed. When you lap the spur over, make the contact point as sharp as possible, or bring it over as a point; it can then be cleansed by the patient. Under such treatment you will have no erosion under either base or precious metal. The contact with the enamel is reduced to the minimum.

Dr. Barnes. There is no question whatever as to the value of gold and platinum appliances from an anesthetic standpoint. There is a question, however, whether it is the most advantageous thing from the utilitarian standpoint. I have had experience for ten years in making appliances: I think to-day that clasp metal and German silver stand at the head. For some purposes I prefer clasp metal; for others German silver. I wish to corrobate the remarks of Dr. Kemple. I think there is less decay under German silver; it contains copper, which is known to be germicidal to some extent. There is too great a tendency to blame the metal or the apparatus for causing decay, or predisposing to decay. The real trouble is fluid, or the detritis within the fluids, caught under the apparatus, which ferments. We should remove appliances more frequently, as Dr. Kemple has advised, whether they seem to need it or not. The danger of the platinum appliance is, it may keep its color very well and yet may be covered over with food products.

I have had the experience of decay occurring under the iridio-platinum more rapidly than under the German silver appliances. Indeed I do not recall any caries occurring under German silver appliances. I rather think there is an electrolytic action where the platinum has gold attachments soldered to it. There is also danger from the German silver appliances, when they are gold plated. The deleterious effects are absent when the German silver is simply polished, without plating.

I prefer iridio-platinum bands for the incisor and cuspid teeth for esthetic reasons. For the bicuspids and molars, I prefer German silver. You will get better service out of German silver or platinoid for molar bands, etc. The point has been made that German silver appliances will get very dark in some mouths, and will not discolor in others. I have found in children from ten to fourteen years of age, that discoloration is most extensive: this is the period of the change of life with boy and girl. The fluids of the mouth are very obnoxious at this time, therefore, particular pains should be taken in cleansing.

The suggestion of Dr. Abell as to using the spur as a point, is a good one. I have followed this plan for a long time satisfactorily.

Dr. H. A. Baker. It was not my intention to discuss this paper, but Dr. Pullen has made the subject so interesting it is more than I can resist.

My experience has been that gold regulating appliances tarnish quite as much as German silver, and the arch wire, unless you use platinized gold, is not as efficient as German silver. When you come to the anchor bands that is another question. If these were made of gold I think it would be an improvement. I also think that the combination of gold anchor bands and German silver arch wire would make an appliance pretty nearly ideal. My experience has been that the German silver anchor bands is that portion which oxidizes the most, but my idea is that this oxidization is beneficial rather than deleterious to the teeth. I cannot recall a case in which I ever had a tooth decay under a German silver band.

I would say that in that retainer of mine which Dr. Pullen is passing around, the cuspid and molar bands are made of 20 k. gold and the wire platinized gold.

Dr. C. A. Hawley. I have been using gold appliances exclusively for about eight months, and while I am enthusiastic over the final outcome of their use, I am not altogether satisfied with the materials. I have been using arches made by Mr. Aderer of New York. So far as efficiency is concerned, I believe they are much better than the German silver arch. They have greater resiliency, will hold their expansion longer, and I believe we may do as much work with the 17 gauge gold as with the 16 gauge German silver arch. They keep cleaner in the mouth, also. I do not think these arches made by Mr. Aderer are really clasp metal. I think they are nearly a 14 k. gold.

Dr. Young. It is a little higher karat than that.

Dr. Hawley. It is not what we have understood as clasp gold The metal is rather brittle, but from the point of efficiency there is little to be desired.

Dr. Ottolengui. How high a grade of solder can you use?

Dr. Hawley. When you get above an 18 k. solder you are approaching a dangerous point

Dr. Ottolengui. That is not a clasp gold,

Dr. Hawley. No, it really is not. Clasp gold is pure gold, and a small per cent. of platinum, and will take 22 k. solder.

Dr. Young. I do not believe there is one piece of clasp metal on the market made in that way.

Dr. Hawley. Our metallurgists define clasp gold as a compound of pure gold and platinum. Whether that gives the greatest amount of elasticity, I do not know.

In regard to discoloration, these arches, of whatever karat they are, discolor in some mouths. That is obviated by gold plating. When gold plated, they keep clean and bright.

As to a metal for clamp bands, I have been using clasp gold. and am not altogether pleased with it. I believe I have more of the bands break than when made of German silver. That is partly due to the fact that the screws I had were not satisfactory. They were of low karat, of same quality of gold as the arches, and would not take high enough karat of solder. Three or four years ago I was looking up the question of materials for plain bands. I thought I had a good one; it was composed of platinum, silver and gold, called platinum alloy. I commenced to use it for the plain bands. It seemed strong, but would break. I had a friend in the physical laboratory of the Ohio State University, who offered to test a number of metals for me. We took strips of iridio-platinum and clasp gold (S.S.W.) and German silver, as well as the platinum alloy, of same dimensions.

He modified a machine he had there that would grasp the ends of a piece of metal and pull it until it would break. It registered the point at which it broke, and the stretch as well. Now it surprised me to find the platinum alloy, which broke oftenest in the mouth, was far stronger than the German silver; nearly twice as strong, but the German silver, before it broke, would stretch three times as much as the other metal. The other metal would not stretch a bit; it was brittle. Iridio-platinum was very strong, and had a good deal of the stretching quality. Clasp metal had not nearly as much stretch as German silver, and was not so strong as iridio-platinum. There is a point. Is not that quality of stretching a very desirable quality in a regulating appliance? I believe it is, but only up to a certain point.

I do not believe, from the experience I have had, that coin gold is a tough metal, and I do not like it very well. We have not found just the right metal yet, I think, with which to make the ideal regulating appliance. We must also find a place to have these appliances made, and have them well made. German silver, I believe, has very desirable qualities, but they are not so great as to overcome the bad qualities of disintegration and discoloration.

Dr. Pullen. I have been much pleased with the discussion, so far as it has gone, and will be pleased to hear more from the members of the Society regarding this subject as their experience in practice with the all-gold appliance increases. I do not claim to have completely thrashed out the subject, but I know we are on the right track, and that this is the main thing.

I shall be brief and concise in closing, because so many of the points I intend to use have been spoken of by members of the society in their individual discussions.

I thought of one thing while Dr. Young was discussing the subject; that is the credit which should be given for some of these things, and I neglected to mention in my address that to Dr. Young belonged credit for the use of the smaller gauge arches in our work. It is a matter of history.

To Dr. Lourie belongs the credit for the first use of the iridio-platinum for plain bands. If there is any question regarding the matter, I want someone to make a statement to that effect. If these things are made a matter of record at the proper time, they do not become questionable later on.

The experience of those of us who have been working with the noble metals has, of course, been varied. I do not think it has been extensive enough, so that we can form absolute conclusions as to which of the noble metals are the very best to use in the different positions in the mouth. They would require different degrees in temper, elasticity, hardness and softness, etc., but we have arrived very near it.

In speaking of the cases in which marked deleterious action on the enamel had taken place on teeth where gold had been used for the appliances, I will say that in my experience I have never had a case of that kind. I am sure it does not apply in any extensive way. It is due to the conditions in the mouth, whereby there would be the same deleterious action whether gold or any other metal were used.

I did not intend to claim to be a pioneer as to the use of gold for regulating appliances. We all know it had been used by dentists before orthodontia, as a specialty, existed. We must get back to something that was good once and is good still and something preferable to German silver, for our appliances.

I think the points made by Dr. Ottolengui, in regard to the method of manufacture of these parts, well taken. He referred to the stripping of the threads of the gold screw, etc. Sometimes there appears to be a frictional quality, which may be overcome by using an iridio-platinum screw and a gold nut on the lingual surface of the molar clamp band. I find platinum is absolutely worthless, as it is too soft; the threads twist off with the least bit of pressure on the nut. We must get a hard alloy of gold or platinum in order to secure threads that will stand. I think one trouble in the stripping of the threads has been in the lack of care in their making.

Suppose a goldsmith manufacturer is just starting in making these all-gold arches; he takes care of the percentages in his alloys, but he neglects the fine mechanical parts, failing to get the threads and nuts accurately made so that they will hold. The manufacturers of German silver regulating appliances have by experience overcome these troubles by using perfected machinery.

The point was mentioned as to deposits on the arch. I have noticed these many times. It is often something from the mouth that is deposited. I never have had it examined.

I confess I do not know anything about aluminum bronze, but will be very glad to know if it has any more valuable qualities than mentioned by Dr. Abell, but it can hardly be compared with the noble metals for appliances.

Dr. Casto spoke of the cost of German silver compared with gold, and indicated his preference for the gold and iridio-platinum as an investment. It is somewhat of a satisfaction to know that every purchase of gold or platinum is a cumulative investment.

In regard to the grades of solder used on various parts of the appliance, I have here one of the iridio-platinum molar clamp bands, and soldered to the buccal surface I have a gold and platinum tube, and between the tube and band is soldered a 14 gauge short piece of pure platinum. It is designated as a pivotal tube anchor clamp band. I use this apparatus in Class II and III cases to tip up the tube without unsoldering from the arch. That little piece of platinum can be soldered to the band with pure gold, and you can use a solder which will flow at lower degree of heat on the other side to attach the tube if you wish.

Here is another point. If you were soldering on the lingual screw, if made of iridio-platinum, there is an advantage in using pure gold. Metallurgists weld pieces of platinum together. The nearest we can approach that is by the use of pure gold for the purpose. I have not used anything under an 18 k. solder, grading down from 22 k. for the different soldered attachments.

Dr. Kemple. You spoke of using hard solder in making attachments to the arches and still retaining the full elasticity of the arch.

Dr. Pullen. There is a trick about that, and perhaps you know it. If you wish to use 18 k. solder in attaching an iridio-platinum hook you may do so, and by just polishing up the arch on your lathe you can restore the temper.

Dr. Kemple. But you have affected the temper in the whole arch.

Dr. Ottolengui. You must heat the whole piece up to one glow, and give the same molecular treatment to all of it; then polish on the lathe and the heat of the buff will restore temper.

Dr. Pullen. Dr. Kemple has found one case where the enamel has been harmed under a gold band.

Dr. Kemple. I have only used the gold band without cement in one case, and then for a short time, because I was compelled to slip the band on and leave it for a limited time only.

Dr. Pullen. In those cases mentioned where gold has been deleterious, they have been so much smaller in percentage than similar cases of trouble occurring where German silver was used, that I do not think they are worth more than a slight consideration. The thought has also come to me that we need more prophylaxis in treating our cases under both German silver and gold. We do not give them the prophylactic care they need. The up-to-date dentists are much more interested in prophylactic treatment and care of the teeth than they were five years ago. Many of my patients are instructed to go to their dentists for prophylactic treatment, necessitating that I remove the appliances and reattach them, etc.

Dr. Hawley. Do you mean that you take off cemented bands?

Dr. Pullen. I do not make a practise of it, but there are men who claim to be specialists in prophylaxis, and I have had to explain to them the bands were cemented on and the teeth were cared for in that way.

I believe that in the four points of efficiency, durability, esthetics and cleanliness, gold and platinum alloys excel and will always excel. We are getting at this matter in a scientific way, and in the next five years I think there will be a great many gold and platinum appliances used, and I am sure we will find the perfection of materials in the noble metals for appliance construction as indicated in my address.

Cements—Their Use In Orthodontia.*

By Dr. W. V-B. Ames, Chicago, Ill.

In accepting your invitation to present the cement subject from the orthodontists' standpoint, I did so without a belief that I could furnish any information specifically beneficial in your application of oxyphosphate cements, and I find at present that I can only treat the subject as it would be of interest to the practitioner in general, except in so far as we need to take cognizance of the fact that your work with cements is almost entirely confined to the setting of bands fitted upon and around the sound teeth, in which condition an amount of expansion is permissible which would be objectionable in the setting of crowns or inlays. For this reason there will be an attempt to make plain the factors accounting for shrinkage and expansion in oxyphosphates. In addition to doing this we must necessarily consider the conditions giving those necessary qualities, adhesiveness and prompt setting in the presence of moisture, without accompanying shrinkage.

Shrinkage and Expansion.

Shrinkage or expansion may occur in oxyphosphates of zinc which crystallize or set to an impervious mass, and does not occur, or rather is never evident, in those in which the setting results in a porous mass. Of the latter class more will be said later.

Shrinkage in an oxyphosphate of zinc is the result of water being given off in the setting process, because the formula has contained water in excess of the amount necessary for proper crystallization, so that the mass, not taking on porosity, it must take on reduced peripheral measurements.

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*This paper and discussion will be found as interesting and useful to inlay workers as to orthodontists.—Editor.

Expansion in an oxyphosphate of zinc is the result of water being taken up in the setting process, because the formula has not contained sufficient water to furnish the water of crystallization for proper setting, when, if water be accessible, it will be taken into the mass with the result of increased peripheral measurements. The setting of an oxyphosphate of zinc in the presence of aqueous moisture, with the taking up of a slight quantity of water, as water of crystallization, instead of giving up some of its acid to the surrounding aqueous moisture, depends upon the modification of the acid by proper phosphates.

"Hydraulic" Cement Defined.

The term "hydraulic," as ordinarily applied to cements, implies that the ingredients of a certain cement will harden even in the presence of a large excess of water. Since the ordinary industrial hydraulic cement depends upon the admixture of water only for action in hardening, the term as applied to a dental oxyphosphate of zinc is apt to be misleading. An absolute, accurately balanced formula would set with neither shrinkage nor expansion and without taking up water of crystallization or without giving off any water. It happens, however, that with some desirable formulæ, this exact balance gives too quick setting, and that a desirable setting quality may be secured by depriving the formula of a slight proportion of water, depending upon the ability of the hardening mass to take up water in the proper quantity for its water of crystallization, without having the balance disturbed at the surface in so doing. It can be reasonably supposed that there is an adjustment of the residual water within, to accommodate the taking up of some at the surface exposed. It will be seen that an oxyphosphate of zinc needing some additional water for proper crystallization need not necessarily be applied to a visibly moist surface, but that if the slight quantity of water needed were present, it would be taken care of. Since, however, the giving in this way of just the proportion of water needed would be a risky undertaking, and since water given at the ultimate exposed surface or surfaces answers the requirements, it is more advisable to have the tooth only normally moist, *i. e., not desiccated,* and to depend upon the taking up of water from without for proper crystallization.

This hydraulic property can be embodied only in such formulæ as tend to give rather quick setting, as otherwise there will be a drawing away of the acid upon subjection to moisture, thereby disturbing the proportions of the formula, with the result of a weakened and porous mass to the depth of the disturbance. A formula can contain residual water to the extent of giving off some in the crystallizing process which will result always in a shrinkage, whereas one being short of water of crystallization will take up the proper quota, if available, with a resulting expansion.

Some cements, conspicuously oxyphosphate of copper, which can not be depended upon to behave properly in the presence of moisture, can be caused to harden so promptly by slight elevation of temperature that they are practically hydraulic, for the reason that they so quickly pass the stage of setting in which they are damaged by moisture.

Adhesion of Cement.

Adhesion of oxyphosphates to surfaces of enamel, dentin, cementum or metal, depends upon the density and strength of the granulated surface of the cement; upon the form of granule agglomerated to compose the surface; the condition of the surfaces presented for cementation, and absence of shrinkage. In other words, the strength of adhesion will be in proportion to the strength of favorably shaped granules composing the cement surface, and the irregularity or porosity presented upon the surfaces to be cemented, this being in contradistinction to the adhesion of a gum mastic to a smoother surface. As the cements used are essentially oxyphosphates of zinc, we will treat them as if they were that, pure and simple, and speak of the powder as oxid of zinc. The strength and density of a cement will depend then upon the powder being a zinc oxid sufficiently basic to give dense vitreous granules, which, when agglomerated by proper basic phosphates, will furnish a mass of greatest strength, and if these dense granules happen to have forms best calculated to knit into the minutest inequalities of the surfaces presented for cementation, then the maximum adhesion is obtained. In connection with form of granule, it can be said that ordinary zinc oxid as obtained by sublimation of metallic zinc, *i. e.,* so-called zinc white or flowers of zinc, is an amorphous substance. The oxid obtained by precipitation of a zinc salt by an alkaline medium is practically the same, and while the specific gravity of these may be changed by calcination, a true crystal is not obtained, and upon reduction to a fine powder there is a return to an amorphous condition. Oxid of zinc in the basic state as obtained by ignition of a salt of zinc, may be granular or crystalline, according to conditions, and if properly crystalline, will help constitute a cement giving the maximum of adhesion, for the reason that needle-like extensions of crystals really knit into the minute inequalities or pores of the surface presented for cementation.

We have spoken of the agglomeration of the granules and crystals by a basic phosphate. To help our understanding, we will define an oxyphosphate of zinc as a mass in which zinc oxid granules are held together or agglomerated by basic phosphate of zinc. This basic phosphate of zinc is formed after presenting an excess of basic zinc oxid to phosphoric acid or an acid solution of the phosphate of one or more of the metals. I mention this because the nature of the resulting agglomerating basic phosphate depends markedly on the particular metallic phosphate used in the modification of the phosphoric acid. The phosphates of the alkaline metals, for instance, used as modifiers, will give porous friable agglomeration media, while the phosphates of some of the non-alkaline metals and rare earths will give dense, glassy, vitreous, agglomerating media, all of which points bear upon the fact that there is a large possible range of quality in these materials, and that oxyphosphates are not necessarily very similar, and as some suppose, merely solution of glacial phosphoric acid for the liquid and zinc oxid for the powder.

Methods of Mixing Cement.

The mixing of an oxyphosphate of zinc for the setting of appliances upon teeth for your purposes, is an art not acquired without some careful attention to details. To have a desirable plasticity at a proper consistency and satisfactory setting, requires a definite procedure, along with a consideration of thermal and hygrometric conditions of the atmosphere and the temperature of the slab upon which the mix is made. I wish at least to call attention to the fact that with a given combination of acid solution and powder, and given humidity, and temperature of air and slab, there is the possibility of a very quick setting with granulation, or a mass which will never set, after having made a mix of a given consistency, all this depending on the too rapid or too gradual addition of powder, or too little or too much spatulation.

Discussion.

Dr. Kemple.

I hardly know what to say in opening this discussion, because to go into the discussion of cements from the standpoint of the chemist would be entirely out of the question with me. We only know what we want, and what properties we require in a cement, and we leave that to Dr. Ames and some of his co-workers to produce. Whether the cement shall have an excess of water, or be a finely balanced cement, or have a deficiency of water, we must leave to Dr. Ames. I believe, however, in the cements I have had experience with, that the manipulation has more to do with producing just the qualities needed than has the exact chemical composition of those cements.

Dr. Ward.

I came over here with the somewhat selfish motive to pick up something rather than to give something; but it affords me pleasure to say a few things on the subject which Dr. Ames has so generously given to the profession as soon as he has worked it out.

There are one or two things which, while they may not appear just the kind of discussion he would like, I would like to thrash out with him. I appreciate quite fully that the demands made upon a manufacturer to-day are about as varied as are the individuals: that one asks for a rapid cement; one asks for the opposite; one asks for an hydraulic cement, while others care little about it; and so on through all the qualities desirable in such a filling material.

Adhesion.

However, I cannot understand how anyone who has met these demands as successfully as Dr. Ames has can fail to appreciate that with the advent of the porcelain and gold inlays, and orthodontia, adhesiveness is the quality of most importance, and that if the maximum adhesiveness is obtained between any two substances the surfaces of the substances must be prepared for the purpose. I do not believe the maximum adhesiveness has been developed in the cements we are supplied with now. But, granting that it has, can we expect a surface that has not been prepared to receive this complex substance that he has told you is affected by the humidity of the air, the temperature, the roughness of the slab, the mixing, etc., to permit of much adhesion?

He has made the statement several times that desiccation was not necessary, and as a result there is a general misunderstanding in this vicinity. He has made the statement that substances which take up air, or cause a rapid evaporation of moisture on the surface of a cavity, should not be used, because the cement would take care of it through its hydraulic property. I have tried both in my practice and with my dynamometer to verify these statements, and have, without exception, found that greater adhesion is obtained by first cleaning the surface with something that would remove grease—sodium carbonate or chloroform being quite effective—and afterward wiping the surface with alcohol. If the temperature of the room is comparatively low, a few blasts of warm air will aid materially in preparing the surface upon which the cement is applied.

I have not been able to get as great adhesiveness from rapid-setting cements as from some of the slower ones, but in no case have I found that great adhesiveness could be obtained without about as much care in preparing the surface as he says is necessary in mixing the cement. None can doubt the effect of moisture upon cements made up from some one of the phosphoric acids after once working with them under the proper conditions to determine it, neither do I think one can doubt the effect of moisture and foreign materials in other forms upon the adhering of an oxyphosphate to tooth structure.

Dr. Ames. I made the statement that I did not feel like going into the manipulation of cements to any extent, for I did not feel like assuming that this was called for, and yet it might have been advantageous to discuss it to a greater extent. When I start on that I do not know where to stop.

Dr. Kemple says the question of how much water the manufacturer should have in the cement formula, whether enough to cause expansion, or have an absolute balance, or so much that some of it would be given up and thus give you a shrinkage, etc., does not concern you. But it should concern you to the extent of making tests by which you can see whether a cement worked according to the instructions of the manufacturer will give you a shrinkage, an expansion, or a zero result, or whether by certain methods of procedure which may be advocated as giving you different results, you might get the difference between a shrinkage and zero, or possibly an expansion.

Dr. Kemple. I am afraid you misunderstood me. I did not mean to say it did not concern the orthodontist in using the cement. I said the orthodontist could only say what properties are most desirable in a cement, and then leave it to the manufacturer to produce. Whether those properties would be given by an excess of water, or by an evenly balanced cement, we leave to the manufacturers.

Dr. Ames. There is such a wide possible range of formula that to satisfy yourself you should make tests of a cement to see whether you get the results desired, and whether (as I call particular attention to in instructions as to manipulation of cements) by rapidly adding the powder, with little spatulation, you get quick setting, and possibly a shrinkage; or by more gradual additions of the powder and more spatulation you get proper working qualities, and probably a slight expansion. By making a large number of small additions of the powder to the liquid, with a great deal of spatulation, you probably get a mass which will never properly set, and which gives a decided expansion.

Dr. Ottolengui. I think I would like to say something that would make more definite Dr. Kemple's thought. You have given the dentist a special cement for temporary teeth—oxyphosphate of copper, and the prosthetic man a special crown and bridge cement, and the inlay man a technic cement for his models. Now, we did not invite you here to tell us how to make them, but to try to induce you to give us an orthodontia cement. What are the qualities we require in such a cement? We need it solely for two purposes; to hold bands on teeth, and to protect those teeth while it is holding those bands in place. Those are the two specific characteristics we want. Also, while a piece of bridge work might need to have two abutments affixed with cement, we very often have, in orthodontic procedure, four bands connected together, and we find it difficult to keep all four of those teeth dry. Therefore, if we can have a little moisture, all the better. If Dr. Ames could put on the market a cement having those characteristics, we would be very glad we had invited him here.

Dr. Ames. I did not feel called upon to come to you, advocating the use of certain cements for the setting of regulating bands, but since I am asked to be more explicit, I will say that with cements of a class, of which Ames's crown and bridge, or inlay for instance, would be examples, taken in colors not too light, to avoid quick setting, if you will make a mix by adding to the portion of liquid a quantity of powder in ten or twelve portions, instead of three or four, the first small additions of powder being quickly and thoroughly distributed to prevent a clotty condition developing, a satisfactory plasticity and adhesion, with a zero state or a very slight expansion and satisfactory setting, should be the result. I do not think it necessary to work out any greater adhesion than may be obtained with the materials we have, when properly handled, recognizing the advantage of using heavily pigmented powder.

I take no notice of an absolute adhesive quality, such as would be attributed to a mastic; but with my inlay cement there is that difference between its powder and that of the crown and bridge cement, that the particles are reduced from a feathery crystal to a finer state, giving you, under the microscope, small, needle-like particles, rather than round-pebbly-shaped pieces, giving a more intimate knitting to the inequalities or pores of the surface. At present I do not know how to increase adhesiveness except from the proper working of what we have.

Dr. Ward. That is what I have reference to. In all processes of crystallization, from the formation of rocks to anything else you may speak of, the slower the process the more complete it will be. When done rapidly it will not be a well arranged one. Cements are too rapid for inlay work where great adhesiveness is desired. Suppose there is some mechanical retention by the feathery crystals running into the tubuli, would it not be more complete if the cement set a little slower?

Dr. Ames. I (with others) cannot get much light on the philosophy of crystallization. A rapid setting cement is more apt to be a shrinking cement. If you can make it have a slight expansion by the method of working it, it will give you greater adhesion than a cement which has a shrinkage.

Dr. Hawley. What is the effect of a flux?

Dr. Ames. You would use up more water of crystallization and get more expansion.

Dr. Hawley. Would you advise the use of a flux to slow setting of the cement when used under clamp bands?

Dr. Ames. Use a slow setting formula or flux. In the extra spatulation you are dissolving the zinc oxid in the phosphoric acid, forming zinc phosphate which acts as a flux, increasing the tendency to take up water of crystallization, and tending to give expansion.

Oxyphosphate of copper was spoken of. It should uniformly set without shrinkage or expansion, and yet has great adhesive qualities. That probably comes from the peculiar basic phosphate of copper formed, giving greater adhesion.

Dr. Ottolengui. Could it be used for band cementation?

Dr. Ames. It would hold a band as nothing else would. With the application of a little heat you can set it so promptly that in a few minutes you may use all the force you would ever want to employ.

I would caution you that I have known of cases where little caps were placed on the cuspid teeth, with the oxyphosphate of copper, showing but a bit of the point, and the teeth drawn down. When caps were taken off there was a little greenish stain there, because of the imperfect enamel, but I believe it can usually be removed. Cyanid of potasium is a natural solvent, and by applying the rubber dam as a protection against this poison, you could get rid of the stain.

Dr. Hoff. The trouble is that the dark stain from the oxyphosphate of copper penetrates too deeply to be removed by any chemical reagent.

Dr. Ames. Where the stain is not objectionable, the oxyphosphate of copper will do what no other cement will do.

As to the extent to which moisture should be removed from teeth.

when I say I advise against desiccation, I mean the literal drying of the tooth, such as is produced when the tooth changes in color many shades from the adjoining teeth. The peripheral measurement of a tooth will change under thorough desiccation, and upon being moistened again it changes to its original condition. So if an inlay were cemented to place in a desiccated tooth, something must break when it becomes moist again. Wipe the normally moist tooth with a solution of sodium carbonate; follow that with distilled water; remove the distilled water with a mere wipe of absorbent material, and then proceed with the application of the cement. I absolutely advise against the use of warm air, alcohol, chloroform or anything which will draw the normal moisture from the tubuli of the tooth. There is a greater chance for the cement to knit into the tubuli if normally moist than if the tooth is desiccated, just on the plan that you can run plaster of Paris better to a moist impression than you can to a dry one. The merest trace of the cement liquid applied to the tooth surface seems an advantage, but it must be a mere trace.

Dr. Ward. If you have water in the tubuli and wipe the cavity out with cotton, which is the more liable to be displaced by teasing in the cement, air or water? Will you get adhesion better with air there or with water?

Dr. Ames. With water.

Dr. Ward. You get capillary attraction, and not adhesion.

Dr. Ames. By getting the cement more accurately adapted to the surface, as you will by having the surface normally moist, you will get whatever adhesion there is possible. I believe in providing for all mechanical knitting possible, and then if we get any of the peculiar molecular force, termed adhesion, we are that much ahead.

Dr. Hoff. The cement takes up the water itself.

Dr. Ames. Yes, there will be a trading off there. The cement will to an extent, I believe, enter the tubuli. There can not be a space because there is plenty of moisture coming from the opposite direction.

The Genesis of the Blood Supply to the Teeth.

By I. N. Broomell, D.D.S., Philadelphia, Pa.

In presenting this subject I do so with the belief that the successful work which the orthodontist is called upon to perform depends largely upon a preservation as nearly as possible of normal physiologic and anatomic conditions in the teeth and in their surroundings, and nothing can be more conducive to this than an attempt to reduce to the minimum the possibility of interference with the vascular supply.

I must confess that I have not been able to keep pace with the literature pertaining to the theory and practice of modern orthodontia, but in days gone by very much was said about the possibility of interference with tooth generation and growth in attempts to "straighten the teeth" through a pinching or strangulation of the blood current. I do not know just what the opinion of the scientific orthodontist of to-day may be regarding the possibility of permanent injury to the teeth through vascular strangulation, but I have been assured that it is not infrequently considered as a possibility.

It must be acknowledged that a free and unhampered blood supply is the one thing essential when the development of an anatomic structure is taking place, and the more complex the organism the more complex and abundant the anastomosis of the capillaries supplying the parts.

This being the case, it should be borne in mind that hypertrophy or overgrowth may result through over-stimulation of the blood current while a diminished blood supply is no less harmful through the possible atrophy or complete destruction which may follow.

One of the older writers on the subject of orthodontia says: "Aside from the mechanical difficulty of moving the teeth, the greatest care must be exercised, for they are tender organs, and devitalization may easily result from pressure." It is known that destruction of the pulp of a fully developed tooth or the papilla of a growing tooth, can only be brought about by an interference with its blood and nerve supply, and it was this thought which prompted the preparation of this paper, intended to embody a consideration of how young, growing teeth are supplied with blood, and of the relationship which exists between the tooth and its vessels during this period.

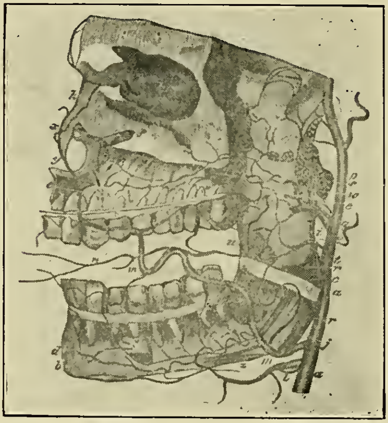


FIG. I.
Blood Supply According to Harris.

Most of the illustrations to be shown are reproductions from a number of dissections made upon human jaws, as well as upon the jaws of the calf and sheep, the result being to establish a belief that the early blood supply to the teeth is a circulation so within itself, that little harm can result from the generous pressure employed in modern orthodontia.

While the dissections establish beyond a doubt the nature of the blood supply to the tooth germs, and the growing and developing roots of young teeth, at the same time they introduce a perplexing anatomic feature which is not thoroughly understood by the writer, and which I trust will receive generous discussion at your hands.

In order to bring the subject clearly before you, and at the same time by comparison introduce the perplexing anatomical feature spoken of, it will be necessary to call attention to some illustrations, old and new, showing the blood supply to the fully developed teeth.

Views of Previous Authors.

Fig. 1. The first illustration is taken from Harris's "Principles and Practice of Dental Surgery," 1850. A portion of the descriptive matter accompanying the same reads: "The inferior dental artery passes along the dental canal beneath the roots of the teeth, sending up a twig to the aperature of each root."

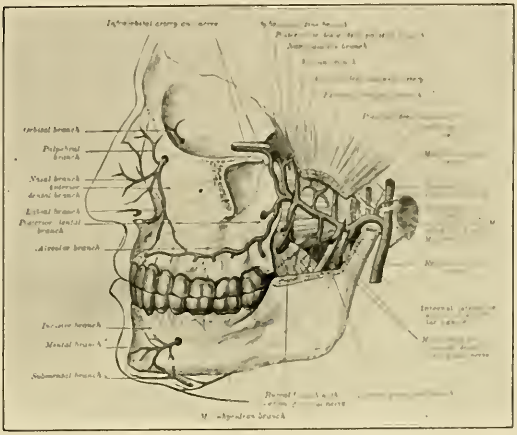


Fig. 2.

Blood Supply According to Morris.

Fig. 2 is reproduced from the last edition of Morris's Anatomy, and is described in part as follows:

"The inferior dental artery passes along the canal in the interior of the bone and gives off branches to the molar, bicuspid and canine teeth."

It will be noted that to a certain extent this diagramatic illustration is erroneous, giving the impression of three roots to the lower molars and two to the lower bicuspids.

Fig. 3. The next illustration, taken from Da Costa's most recent work, is described in part as follows:

"The inferior dental artery courses through the substance of the bone and gives off a few twigs, which are lost in the cancellous tissue, and a series of branches, which correspond in number to the roots of the teeth.

Here again the illustration is misleading, as there is but a single branch for each of the eight teeth.

In a general way all of these authorities agree as to the ultimate mode of a vascular supply to the teeth, but none of them throws any light upon the distribution of the blood to developing teeth.

If we recognize the foregoing as the final anatomical arrangement of the blood vessels supplying the teeth, I will venture the assertion that the manner by which such a distribution is brought about is most mysterious, after a careful study of the various dissections (illustrations of which are to follow) are carefully taken into consideration.

Permit me to introduce a drawing by Constant (Fig. 4), so frequently employed in text-books to illustrate his theory that the blood pressure is responsible for the elevation or eruption of the teeth.

To this arrangement of the blood supply at this time I purpose to take most emphatic exceptions, and hope to prove that no such arrangement of the blood vessels as shown on the diagram exists in the young or partly developed tooth crowns. While blood pressure may and likely does exist, as a controlling influence over the eruption of the teeth, it is not by any such simple arrangement as that here shown by Constant.

In addition, I quote and take exception to the theory and belief of W. Lepkowski, which are as follows:

"In the fetus of seven months the alveolar artery provides one branch for each tooth germ, which is thus entered at its base. The artery before its entrance into the sac, is still to be recognized as such."

I take exception to this statement, because it is incorrect.

I believe that no apology is necessary for introducing at this time a few old slides made from a series of dissections upon human embryos and originally used in the study of the follicular stage of tooth development. These should be especially permissible at this time, because it was while these dissections were being carried on that the thoughts included in this paper were first presented to the writer.

Dr. Broomell's Views.

Fig. 5 shows a dissection made upon the mandible of a four-months' fetus, the object being to separate all of the soft tissue from the growing bone. In making such a dissection as this for the purpose intended, it is essential that the incision along the base of the bone be made deep enough to include the periosteum; otherwise the tooth follicles will be more or less mutilated in attempting to lift them from the bony incasements.

The illustration shows the dissection complete, the bone and soft tissue being separated, and in this we have the first opportunity to introduce the essential features of the subject under consideration, which are as follows:

At this stage in the process of tooth development there is no connection between the inferior dental artery, already located in the substance of the bone, and the growing teeth. There is no such condition present as described and diagramatically illustrated by Constant and others. It may be argued that the process of growth in the teeth has not advanced sufficiently to expect the distribution of a special arterial branch to each follicle, or it may be said that these branches are present at this time, or have been broken off during dissection.

To contradict the former, this slide (Fig. 6) is introduced, and it will be seen that the crowns of the teeth are advanced to a stage equal to those showing the early stages in Constant's diagram, or about the sixth embryonic month, while the next slide (Fig. 7) shows the base of the follicles, as well as the bottoms of the crypts from which they have been dislodged. Yet there is no evidence in the picture of the passage of the blood vessels from the main artery to the individual teeth.

I might pause here to explain that with the most careful search instituted at the time of making these dissections, there was not the slightest evidence of a blood supply being given to the follicles by branches from the main artery.

Fig. 8 shows the mandible from a child one month after birth, at which time the crowns of the deciduous teeth are fully calcified. The inferior dental canal, devoid of its contents, is shown, and the relationship between it and the tooth follicles is clearly evident.

Even at this stage in the general development of the parts, no vascular communication has been established between the main artery and teeth.

Fig. 9 shows a dissection of the upper jaw and hard palate of a child, and exhibits the follicles of both the deciduous and permanent teeth, the soft tissue having been lifted from the bone and turned over. These follicles were not tied down to the bone by vessels, nor was there any evidence of vessels entering through the bone.

To make the subject more readily understood and to present what is believed to be the true condition, a diagram has been prepared, Fig. 10, "B," representing the established theory of Constant and others; "A," what is believed to be the real conditions as found by the writer in the numerous dissections made.

In the former the blood supply is seen to come from below by a single arterial twig. In the latter it comes from above by many minute vessels which arise in the gingival tissue, and find their way into the pulp after coursing through the walls of the dental follicle.

In this connection it is well to recall the fact that the separate tissues of the developing teeth, and the connective tissue walls which surround them, are supplied by separate sets of vessels. That is, those tissues of epiblastic origin are supplied by a superficial set of vessels, while those of mesoblastic origin, which include the walls of the follicle and the dental papilla, are supplied by a separate and distinct set of vessels.

It is also known that with the transformation of the walls of the follicle into the alveolo-dental membrane there is established a free anastomosis between the two sets of vessels, and not until that time is the permanent vascular supply to the teeth fully complete.

Not being content with the dissections just shown, which were made several years ago, and to more fully establish the theory here advanced, I have recently made some dissections upon the jaws of the calf, results of which will now be shown.

Fig. 11 shows a dissection upon the molar region of the mandible, which exposes to view some teeth well developed and others yet in the follicular stage.

The mandibular canal is laid open and the common sheath is shown. It will be noticed that while the sheath is in very close relationship to the base of the developing teeth, there are no communicating vessels between it and the follicular walls. This applies to the molar, with its entire crown calcified, as well as to the younger teeth in which no calcification has taken place.

Fig. 12 shows the same dissection with the large follicle dislodged from its crypt, this being done without the rupture of blood vessels, which could not be the case if they existed as described by Constant.

Fig. 13 shows the common sheath pulled out of the canal, and serves further to prove the theory that there is no communication between it and the growing teeth.

Fig. 14 shows a similar dissection made upon an older subject, with like results.

While no attempt has been made to study the subject from microscopic sections, is it not strange that out of the thousands of longitudinal sections made of developing teeth and tooth germs and their associated parts, not one of these, so far as my observation goes, includes the walls of a vessel passing from the main artery to the root apex or base of the papilla? We see the main artery in transverse section near by, but the connecting vessel is always absent. It may be said that these blood vessels are not of sufficient size to be observed with the naked eye and

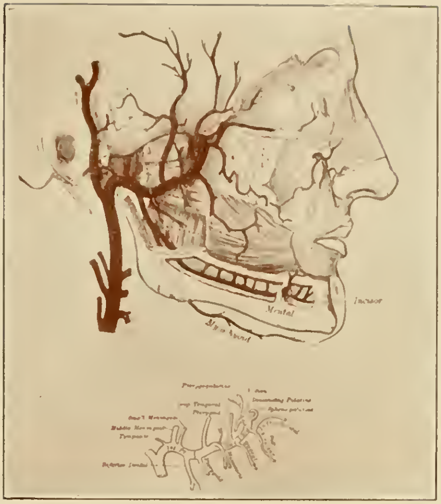


FIG. 3.

Blood supply according to Da Costa.

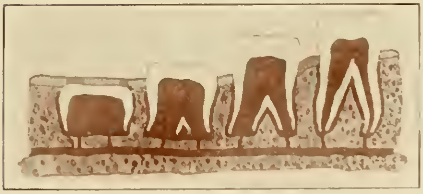


FIG. 4.

Blood supply according to Constant.

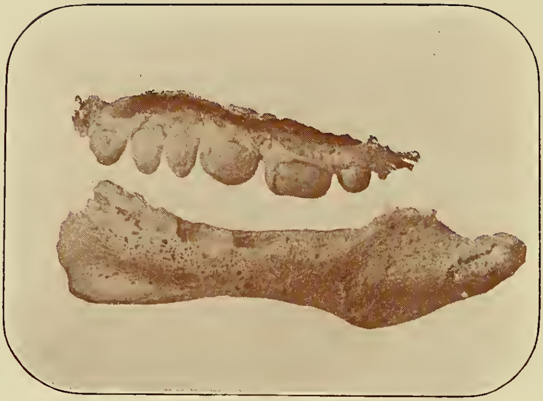


Fig. 5.

Mandible from fetus—fourth month. Tooth follicles lifted from bony sockets.

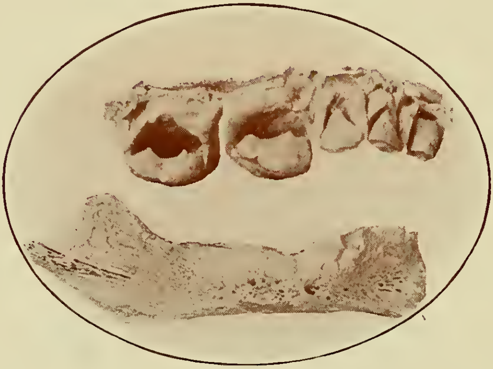


Fig. 6.

Mandible with follicles dissected out. Sixth embryonic month.

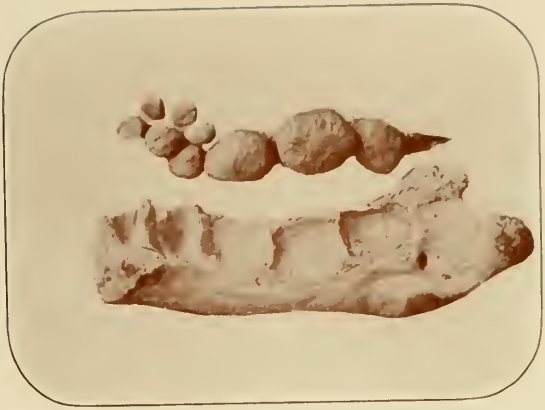


Fig. 7.

Mandible with follicles dissected out.
The specimens are turned to show the bases of the follicles
and bottoms of the crypts.

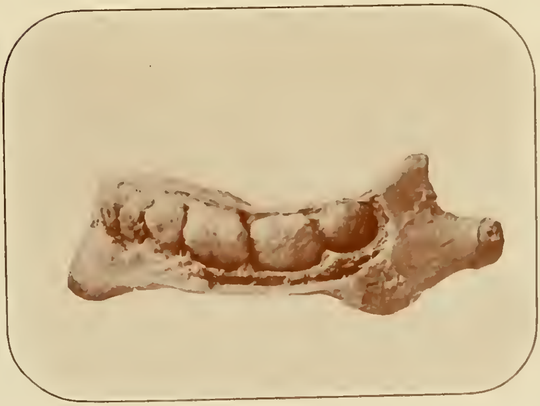


Fig. 8.

Mandible of child, one month after birth. Crowns calicfied
at this period. Dissection shows follicles and
discloses mandibular canal.

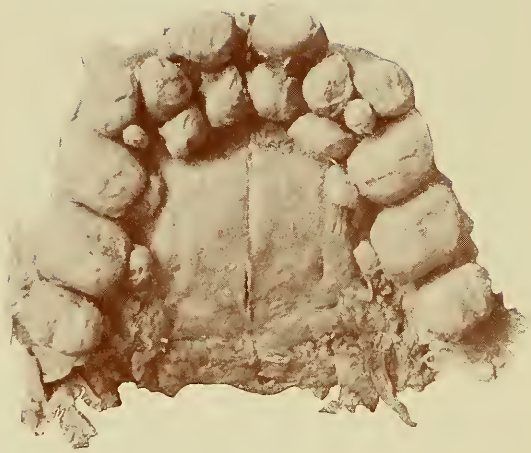
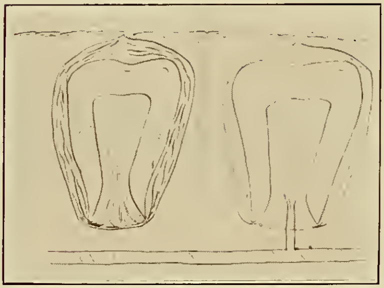


FIG. 9.

Dissection of soft tissues from hard palate and maxilla of a child. Follicles of both deciduous and permanent teeth lifted from their crypts.



A B

FIG. 10.

Schematic diagram of blood supply.

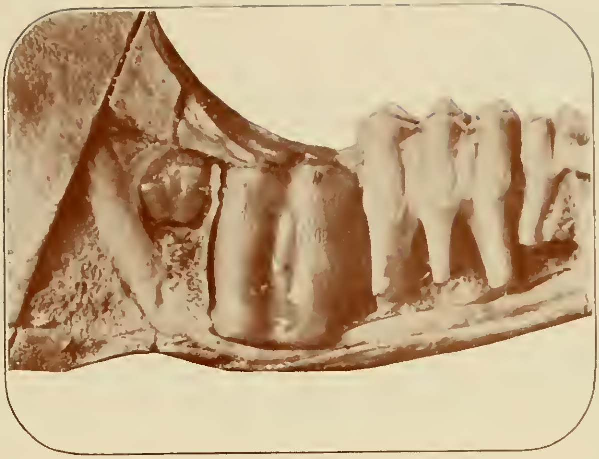


Fig. 11.

Dissection of mandible showing teeth in advanced stage of calcification, and also follicular stages.

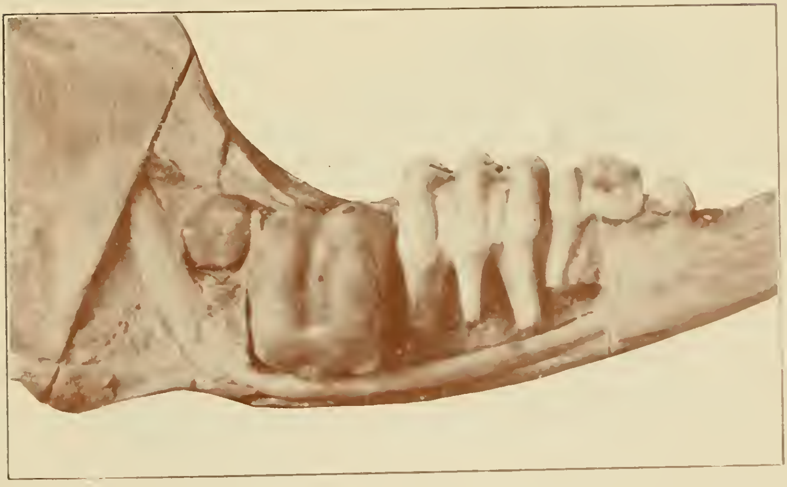


Fig. 12.

Same as 11. Large follicle dislodged.

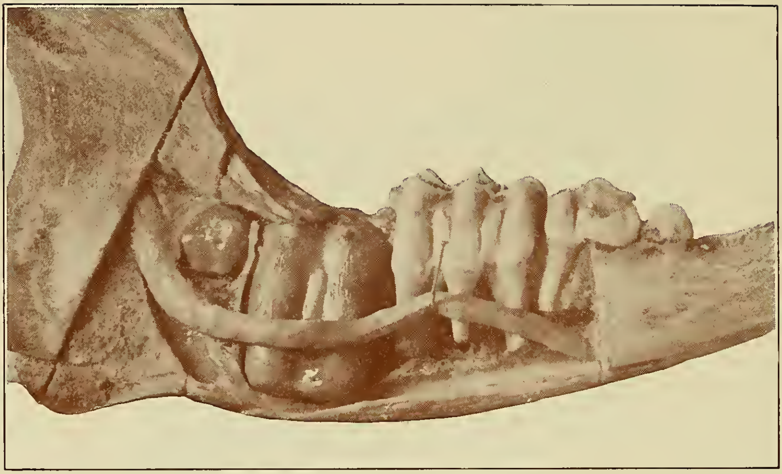


Fig. 13.

Same with sheath lifted out of canal.

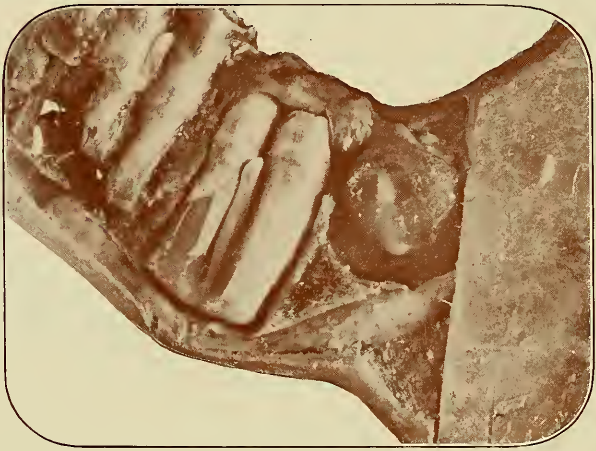


Fig. 14.

Similar dissection on older subject.

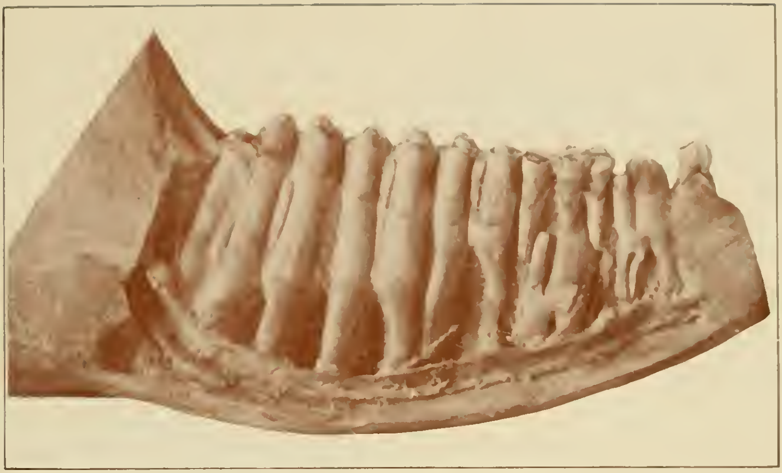


Fig. 15.

Dissection of mandible of an ox. Sheath dissected away disclosing artery.

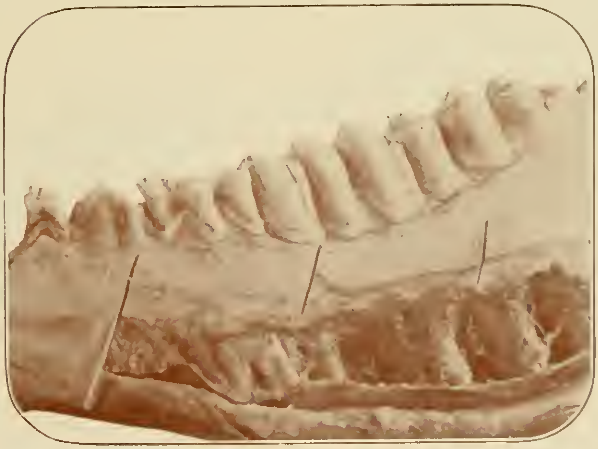


Fig. 16.

Showing roof of mandibular canal.

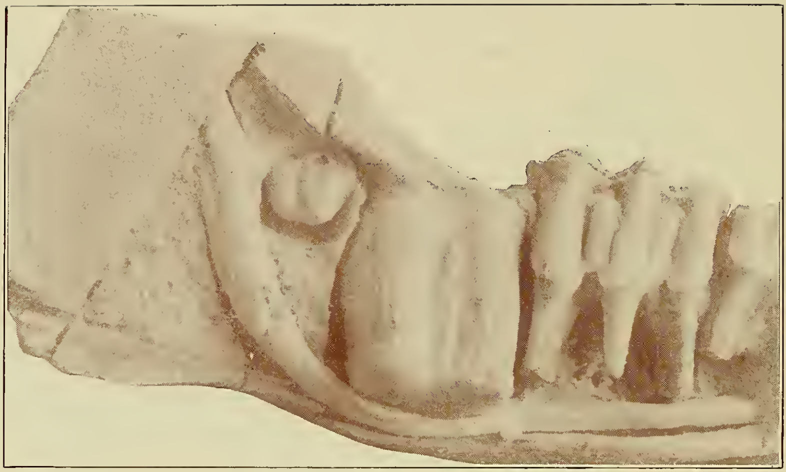


Fig. 17.

Vessels in follicles injected.

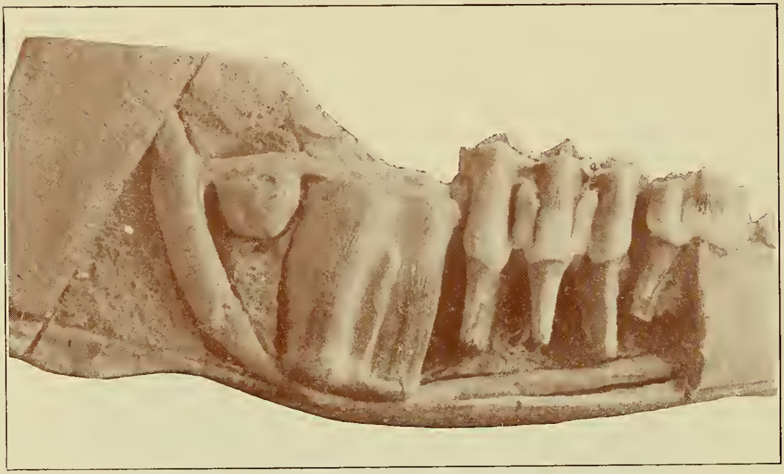


Fig. 18.

Showing secondary sheath branching from mandibular sheath, and passing forward over tops of follicles.

that microscopic sections should be depended upon only for a general study of the subject. These thoughts occurred to the writer, and for this reason some dissections were made on the mandible of an ox. In this the common sheath carrying the blood vessels and nerves of the mandibular canal measures three-quarters of an inch in diameter, and the lumen of the artery proper measures about three-sixteenth of an inch.

Hopewell Smith claims that the blood vessels of a human cuspid pulp are microscopically visible, and if this be so, they would be proportionately larger before entering the pulp, and very much larger in a jaw having the dimensions of those of an ox.

The next illustration, Fig. 15, shows a similar dissection made on the mandible of an ox, with the common mandibular sheath dissected away, exposing to view the artery, the same having been previously carefully injected. While several minute branches are given off, these do not correspond in position or number to the root apices.

Fig. 16 is a view of what might be called the "roof" of the mandibular canal, the same being in immediate contact with the root apices. In this specimen, somewhat incomplete, the mandibular sheath and its contents have fallen away, simply from lack of support. The open end of an incomplete root is shown, but no vessel penetrates it from the main artery.

As stated elsewhere in this paper my belief is that during the follicular stage of development, the papillæ or future pulp is supplied by vessels which reach it after coursing through the walls of the follicle.

Fig. 17 shows these vessels in the walls of the follicle after being injected, this injection having been made into the mandibular artery, and having reached the minute vessels in the walls of the follicle, the query naturally presents itself as to how this could be brought about if there be no connection between the two? This complication prompted a further dissection, the results of which are shown in Fig. 18.

Here we have shown a condition which would practically seem to prove the theory advanced. A secondary sheath given off from the main sheath and passing forward over the crowns of two developing teeth, and providing in this way a vascular supply to these follicles. Inasmuch as this sheath could not be traced beyond the two follicles shown, it is natural to believe that it has but a transitory existence and that it atrophies soon after the eruption of the teeth. It must be born in mind that this sheath is not a part of the gingival tissue, but has a separate and distinct existence, forming a canal for itself in the upper portion of the ramus of the jaw.

Conclusions. The blood supply to the dental follicles and growing teeth differs from that of the completely formed teeth in the mode of its general distribution. That is, while a blood vessel or single arterial twig *may* enter the apical foramen in the fully developed tooth, passing directly from the main artery in doing so, the blood supply to the tooth previous to this time is, as described, from the walls of the follicle, independent of the main artery.

The theory of Constant and others regarding the genesis of blood supply to the teeth is erroneous. Mature teeth are supplied with blood by branches from the main maxillary arteries, but this supply is received through the numerous common vessels which traverse the cancellated bony tissue of the jaw and the alveoli, forming a free anastomosis, some of the vessels of which enter the pulp through the root apex.

The practical bearing which this paper may have to the orthodontist is only such as may be applied when this difference in the early arrangement of the blood current is understood and generally accepted.

Discussion.

Dr. Pullen. I consider this paper one of the most important that has ever been presented before this society in the scientific data obtained by actual dissections, and because of its subject matter. In my opinion the genesis of the blood supply to the teeth is of more importance to us than to the general practitioner, for we are dealing every day with developmental conditions in our study and practice.

The photographs show such perfection in the dissections that there can be no doubt as to the scientific value of the work done; and the conclusions drawn are logical and bound to revolutionize the ideas on the subject which have been heretofore held.

Dr. Ottolengui. Mr. President and Gentlemen: I feel very proud that the society could have a paper of this kind, and I feel very proud of the fact that, in a sense, Dr. Broomell has done such beautiful work for us, and for me. You heard him say this work was begun some years ago; part of it was done at that time, and a good part of it has been done especially for our society, as you have seen. Now I think the origin of this paper, if I am not mistaken, arose a number of years ago when Dr. Rhein, of New

York, asked me my views on the blood supply. I had not any at that time, except that I doubted the prevailing views as expressed by diagrams. I ask you to compare that sort of evidence with what Dr. Broomell presents. Dr. Rhein explained to me the purpose of his inquiry, which was that he had conceived the idea that in diseased conditions of the pericemental tissue (such as pyorrhea) the pulp having finished its functional work, might be removed in order to give a greater supply of blood to the pericementum; but of course if the blood supply came in through a vessel which entered the apex, and traced upward or downward to the main artery, the extirpation of the pulp would merely mean the retraction of the broken arteriole, and the purpose of affording additional blood to the pericementum would not be attained. I sent out this problem to a number working in this field, among them Drs. Broomell, Williams, Black, Suddust and others. Their views were published. They were carefully stated, but largely unproven. None really accepted the diagrammatic explanations of the text books. Dr. Broomell then undertook to discover what is really true. So you will appreciate this paper when you realize that the work has covered a great number of years. The final work has been done in answer to our request.

As soon as Dr. Rhein received the encouragement of the scientists in the profession, he began following the new treatment. He has kept a tabulated history of cases which he has treated by pulp extirpation, and it is now an established fact, acknowledged by the profession, that the pulp may be purposely destroyed in a tooth suffering from disease, with advantage to the pericementum; so that it appears that this view that the blood supply is reflected from the vessels in the pericementum has the support of clinical experience.

Now it remains for us as orthodontists to add this knowledge to our work and to rely on it. For example, it makes a difference in accellerating the eruption of a tooth to know whether we are stretching an arteriole in bringing the tooth down or up, or whether we bring the arterial supply down with the pericementum. If we are to move teeth it is absolutely essential we should understand the blood supply.

In taking my seat I can only express the wish that the second half of this paper will come to our society, because I do not believe there is a society in the world that would appreciate it more. I want to thank Dr. Broomell personally and from the bottom of my heart for the beautiful work he has done, and to say I have never seen better dissections, photographs and slides, and more absolute proof of facts claimed, than he has given me to-night. I think it will revolutionize the teaching on this subject.

Dr. C. P. Bethel, Columbus, O. We all know that Dr. Cryer some years ago made extensive investigations regarding the internal anatomy of the face, etc., and brought to light information that was a revelation to the profession, but it has remained for Dr. Broomell to further investigate and bring to our notice the true conditions of the genesis of the blood supply to erupting teeth.

Dr. Ottolengui has spoken about the conditions in so-called pyorrhea, but it seems as though Dr. Broomell's discovery is of especial interest to the orthodontist from the mechanical standpoint that the blood supply coming in this way instead of from a distinct artery entering the apex, there is less liability of disturbance to the pulp during movement of the teeth—that is, the careful movement of the teeth and in the extent of such movement.

There have been a number of cases reported of death of the pulp through tooth movement, particularly through rotation, and some through elongation, but as I understand it, they were cases where there had been forcible elongation or too rapid rotation, probably accompanied by a rupture of fibers of the peridental membrane. These cases would, indeed, do more to confirm the idea of Dr. Broomell than to sustain the old idea of the blood supply, because if the supply comes through the fibers of the pericemental membrane, supplying the pulp as well as the membrane itself, by cutting off the fibers and tearing them loose from their attachment in the alveolus, we will cut off, or interfere with, the blood supply to the pulp, and the probable consequence would be congestion and death of the pulp of the tooth. That should be a warning to the orthodontist to use particular care in the rotation of the teeth, and in the case of those teeth in which the pulps have died from rotation it would seem to be more through the tearing away of the attachment of the fibers of the pericemental membrane than from the rupture of any distinct vessel that might pass through the apex of the root, because in torsion we would not get the strain on such a distinct vessel that we would get from the forcible elongation of a tooth. So it will teach us to be particularly careful not to rotate teeth too rapidly.

So far as the extent of tooth movement is concerned, it seems as though it would be of distinct advantage to us; we can move a tooth to almost any extent without especial danger to its pulp. I have a case in mind where the lateral incisors were lingually placed, and were carried forward to fully the distance of one-half inch. The pulp was not apparently injured in the movement of those teeth, so I merely speak of it to show to what an extent teeth may be safely carried. You have all had this experience yourselves. Another thought is, that if a great portion of the blood supply of the teeth comes through the gum tissue, what effect will a long continued congested condition of the gums, through irritation of ligatures and appliances, have on the tooth tissues themselves? Now I want to indorse what Dr. Ottolengui has said regarding Dr. Broomell's second presentation. I think we owe him a great debt of gratitude for coming here, and for having done this work for us. I hope that next year he will be placed on the programme, and that he will in the meantime continue his studies along this line and see what he can determine regarding the blood supply of teeth where there has been full development, and the roots have been fully matured, as I understand he has not carried his investigations that far as yet. In this connection we would also like to have him continue his studies with regard to the pericemental membrane, and bring that also to us later on. I think these are very valuable studies, and coming from a man of the ability of Dr. Broomell we can consider ourselves very fortunate, indeed, to have the advantages of this great work, and I am sure we are all very thankful to him for it.

Dr. Henry Baker, Boston.

Mr. President: This paper of Dr. Broomell's is worth to me the whole trip to Detroit.

If any one had told me before this that in the formation of the teeth there was no artery direct to each tooth pulp, I should have been very skeptical; after seeing Dr. Broomell's lantern slides, and listening to his paper, I do not see how it is possible for any one not to be convinced. His paper has made the subject very clear and simple. In following this paper there is between the lines something that makes one think; namely, the amount of study and work involved in getting these specimens to enable him to get such clear and perfect lantern slides and impress so forcibly upon our minds that there is not a question of doubt as to the correctness of his theory. To me it has been extremely interesting and instructive.

Dr. William Watson, Detroit.

I want to express my deep appreciation to Dr. Broomell for his real contribution to science, and to repeat what Dr. Ottolengui said to me a moment ago in speaking of the beautiful illustrations: "They beat argument all to pieces." I also move, Mr. President, that the American Society of Orthodontists request Dr. Broomell to carry this investigation on in relation to the fully calcified teeth, and that the expense of such an investigation be borne by this society.

Dr. Casto.

I have appreciated Dr. Broomell's paper very much. The question of the blood supply to the teeth, as presented by him, has been a revelation to me. I have always been under the impression that there was a direct connection between the main blood vessels and the pulps of the teeth. I call to mind Dr. Cryer's illustrations in which he shows small bony tubes extending from the inferior dental canal toward the apices of the teeth, which he supposed carry the blood vessels and nerves to supply the pulp and peridental membrane.

In discussing the elongation of the mandible, Dr. Cryer claims that the inferior dental tube is stretched and that the small tubes connecting the main canal with the apical spaces are carried forward, which accounts for their posterior inclination, and which he claims furnishes evidence of an interstitial growth of the mandible.

I do not quite understand whether Dr. Broomell's conclusions were based only upon the early formation of the teeth. I would like to ask him at what time, if ever, the direct relation between the main artery in the inferior dental canal and the tissue at the apical space is established?

Dr. I. Norman Broomell. As to Dr. Casto's question I am not able to answer it. There is where I have stopped. He speaks of the work of Cryer. I do not think his dissections absolutely show tubes running directly, or even in a twisting fashion, from the main artery to the root apices. If you will examine those specimens carefully, you will find the tubes are nothing more nor less than the cribriform arrangement of the bone, and they do not run directly to the individual roots of the teeth. No one has yet succeeded in pointing out positively that arterial twigs do pass from the main artery to the roots of the teeth. Therefore, I cannot answer the question as to the time when such a condition takes place, if it does take place at all. At the present time I am very much of the opinion, although I am not ready to make the statement, that there is no direct blood supply from the main artery to the root apices. I believe the blood supply is one which is established after the complete formation of the alveolar-dental membrane by a series of anastomosing vessels around the apical space, these vessels coming via the alveolar walls as well as from the gingival tissue.

Dr. C. Lowe Young. You are in Philadelphia, Dr. Broomell, where Dr. Garretson used to remove the inferior dental nerve and blood vessels. Have you ever seen in any one of those patients in what condition the teeth were in?

Dr. Broomell. I have not.

Dr. Ottolengui. In answer to that I may remind you of the many cases of fractured jaws where there is a complete fracture and consequently a complete separation of all the vessels, including the canal. It is not conceivable that the artery reunites.

Dr. Barnes. Do I understand you correctly, that there is never an apical arterial supply?

Dr. Broomell. I am not ready to make such a statement at this time. I thank you very much for your attention, and am only sorry I must leave at this time.

Dr. Kemple. I move that a very hearty vote of thanks be extended to Dr. Broomell for his splendid paper.

Resolution adopted by rising vote. Dr. Broomell was then unanimously elected an honorary member of the society.

The Influence of Nasal Obstruction and Mouth Breathing Upon the Development of the Face, Palate, Teeth, and Chest.

By Henry J. Hartz, M.D., Detroit, Mich.

The ill effects of nasal obstruction and mouth breathing appear to have been well recognized by the ancients. In the seventh book of "Epidemics" Hippocrates describes the clinical symptoms of nasal diseases, mentioning the high-arched palate, the irregular teeth, the headaches and the ear discharge; also the defective chest development. Even among the aboriginal tribes obstruction to breathing was noticed and treated. An Indian maxim reads that "the man breathing through the mouth is a weak man, the man breathing through the nose a strong man;" while to-day the mothers of the Sandwich Island tribe clear the infant's nose from obstructing secretions by suction with their mouths.

Mouth Breathing a Cause of Nasal Obstruction.

Dr. Mayers, of Copenhagen, first disclosed the local and remote significance of nasal obstruction. He revealed that the enlarged lymphoid tissue in the nasopharynx, the adenoids, was one of the causes. Since that time, which was in the year 1873, different observers have found other causes of nasal stoppage; such as septal deviation, spurs and enlarged turbinate bodies; also the open bite, the result of deformed jaws and imperfect apposition of teeth, especially the protruding teeth over which the lips can not close perfectly, a condition which often renders an open nasal channel useless. To-day we estimate that about 70 per cent. of the children are more or less mouth breathers. Many of them breathe normally through the nose, while the body is erect during the day, but when in a recumbent position, the blood extravasates into the soft tissue of the nose, and induces obstruction of the lumen. As a rule, acute inflammation of the child's nose remains untreated, becomes chronic, and the turbinated bodies pass through the stage of hypertrophy and hyperplasia, which soon extends to the rear of the nose, and involves the nasopharynx, provoking the formation of adenoid vegetation. The substitution of oral respiration for the nasal fails to give the proper degree of moisture and heat to the inspired air, and, moreover, admits into the mouth countless germs and irritating dust, which would normally find lodgment in the vestibule of the nose. Mouth breathing leads to dryness of the mucous membranes, which predisposes to catarrhal states of the mouth and upper air tract, more especially in the region of the nasopharynx; the protecting layers of the epithelium are disintegrated, and such membranes invite infection, while frequent attacks of inflammation provoke an increase in the size of the tonsils.

Phagocytosis, which is continually in progress within the tonsils in catarrhal conditions, produces hypertrophy; and unless corrected, the catarrhal process may invade the accessory sinuses, and sooner or later spread to contiguous parts, such as the ear and the lower air passages. The secretions are usually swallowed, because the child has never had control over the muscles which perform the act of expectoration; hence, this mucus, frequently mixed with disease producing bacteria, finds its way into the gastro-intestinal tract, producing digestive disorders of toxic origin. The difficult task of adapting himself to mouth breathing is somewhat modified during the day, when the child consciously keeps the mouth open to let in sufficient air. In sleep, however, the muscles involuntarily close the mouth, rendering respiration labored and well-nigh impossible. The child has disturbing dreams, is very restless, and often awakens in perspiration.

Evil Results of Mouth Breathing.

For successful oral respiration two changes are necessary: first, the depressing muscles of the lower jaw must be in action to open the mouth; and secondly, the tongue must undergo a change of its position from the roof of the mouth, its normal position, to the floor of the mouth. Much of the restlessness and disturbance of the nutrition of the child is due to the period of adaptation to breathe through the mouth. Add to this the insufficient oxygenation and the digestive disturbances, which he can not escape, and we have sufficient cause for considering the ill effects of nasal stenosis and mouth breathing, as factors in retarding the growth of the entire body, both local and constitutional. With the changed position of the tongue in mouth breathing, the force which the tongue exerts upon the hard palate on its normal growth is lost, resulting, probably, in a narrowed arch instead of the normal curve.

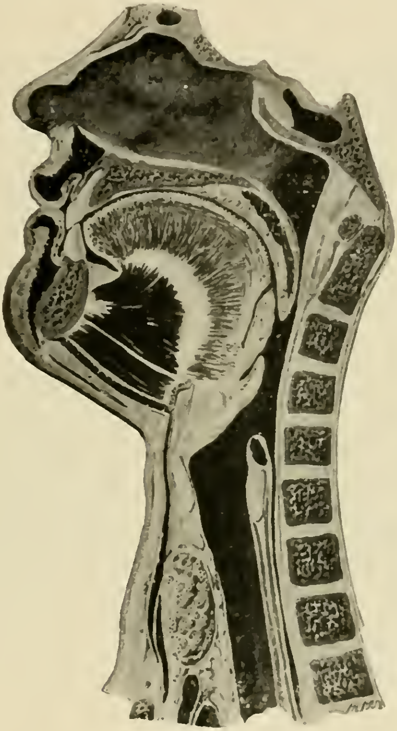


FIG. 1.

During nasal respiration the strong fan-shaped muscle of the tongue is in its normal position, pushing forward and sideways against the hard palate, shaping its growth (Fig. 1). Its position is reversed during mouth breathing, when it drops to the floor of the mouth, and its influence upon the hard palate is lost.

With the mouth closed the tongue rests normally against the upper teeth, and presses sideways and forward on the hard palate. The tendency of this force is to make the palate conform to the shape of the tongue, especially during swallowing and speaking. Thus, mouth breathing, aside from inviting infection, removes the force of the tongue, which is constantly aiding in the normal growth of the hard palate.

Etiology of Deformities.

The etiology of deformities of the face, palate and teeth is still a subject of debate. Some authorities believe that an obscure condition of malnutrition plays an important role; likewise that heredity determines the structure of face, palate, teeth and chest, rather than the post natal influences of nasal stenosis and oral respiration. In the endeavor to determine some of the causes of maldevelopment in the child's face, it may be profitable to study its normal development, and the forces that might retard growth, and also to take into consideration its embryonic development; for, at this period, it is likewise exposed, and frequently the foundation is laid for future deformities.

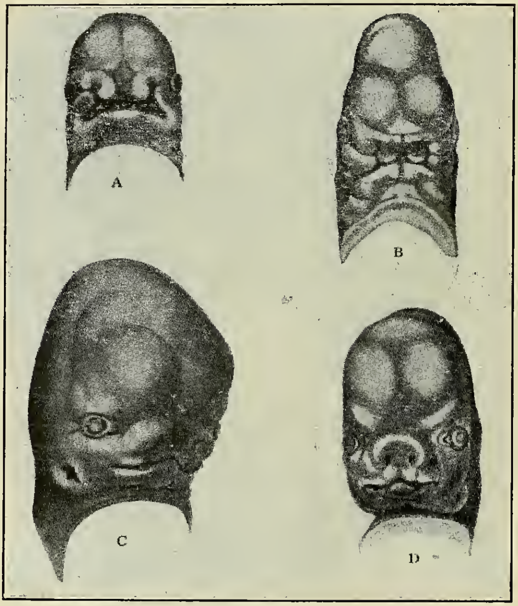


FIG. 2.

A. Embryo of about twenty-nine days. The nàso-frontal plate differentiating into processes of first visceral arch are extending. B. Embryo of about thirty-four days; the globular, lateral, frontal and maxillary processes are in apposition; the primitive opening is now better defined. C. Embryo of about the eighth week; immediate boundaries of mouth are more definite and the nasal orifices are partly formed, the external ear appearing. D. Embryo at end of second month.

During intra-uterine life the factors that may imperil physiological growth are the infectious diseases of the parents, malnutrition, shock or injuries. For instance, it is recognized that a deficient amount of amniotic fluid exposes the embryo to injuries and undue pressure, owing to the fact that the elastic support of the normal quantity of the fluid is lost. Furthermore, the injuries sustained during difficult labor must be taken into account; likewise the trauma of instruments in the hands of the accoucher. Prognathism is sometimes produced in breech presentations by the hands of the obstetrician while making traction on the lower jaw of the child, causing displacement of the temporo-mandibular joint. It is held that a cleft palate may be caused by injury of the embryo, the mandible pressing into the maxilla, thus preventing union of the palate suture.

The changes in the embryonic nose are important as an essential to the growth of the face. The first indication of the formation of the nose in the embryo may be seen at the second month when a groove makes its appearance on the frontal protuberance, then two projections form on each side, termed nasal processes, the external pair developing the outer walls of the nose, the internal forming the septum (Fig. 2).

The mandibular, or first pharyngeal, arch divides into two parts, the superior joining with the opposite side to create the upper jaw, while the union of the inferior maxillary portions go to form the lower jaw, and the nasal processes grow downward, at the tenth week reaching the floor of the nose, which has been formed by the union of the two superior portions of the mandibular arch. The septum of the embryo is formed of two parts, which coalesce at the second month, and which at this time consist of cartilage. Beginning at the third month of intra-uterine life, ossification begins on both sides of the septum, which now unites to form the vomer. Into the groove of the vomer the perpendicular plate of the ethmoid is fitted in its anterior aspect, the rostrum of the sphenoid bone joins above and the nasal crest of the superior maxillary and the palate bones below. Thus the vomer is securely locked in its place by surrounding bones. Septal deformities and spurs have been found to exist as early as the sixth month in the embryo. The ethmoid plate does not begin to ossify until the sixth month of infancy. Starting from the body of the ethmoid it reaches the vomer in the third year, and the process is completed about the sixth year. Premature ossification of sutures of the facial bones results in lack of growth, and the nasal space remains abnormally small, especially when affecting the inter-palate, intermaxillary and the vomerine suture. An obscure form of malnutrition, such as rickets, is held to be the cause. In infancy the bridge of the nose is low and undeveloped, and the openings are on a plane with the face, the apex being tipped upward; but as the septum develops, the bridge is elevated and the openings are directed downward, arresting in this manner the development of the perpendicular plate of the ethmoid bone, causing the deformity known as pug nose. Unlike other bones, those of the face are not developed from cartilage, but are produced within sheets of consecutive tissue, and are, therefore, spoken of as arising by intra-membranous development.

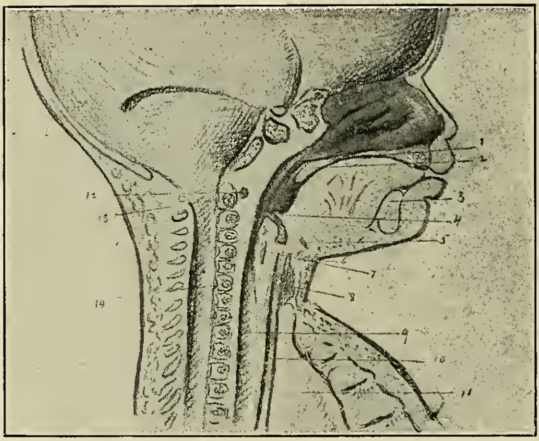


Fig. 3.

Section of head of a newly born infant, showing the predominance of the ethmoidal nasal space over the maxillary. The face, while helping to form the orbit and nasal cavity, is essentially for the jaws and teeth. The greatest change is the downward growth of the face. In the infant the face is to the cranium as one to eight; at two years, as one to six; at five years, as one to four; at ten years, as one to three; and in the adult, as one to two.

Embryologists have demonstrated that the nasal passages of the child differ in relative size and form from those of the adult.

For while the ethmoidal portion of the nasal space is twice as high as that of the maxillary portion in the child at birth, in the adult they are of equal height. Somewhere near the eighth year the nasal space assumes relative adult proportions, and the maxillary portion equals in height that of the ethmoidal portion.

And with this growth and the descent of the hard palate the nostrils develop slowly. Thus during this period of seven years the nasal organ of the child is under stress; normal development is taking place, while respiration is confined chiefly to the upper ethmoidal portion, the lower portion being very narrow and the inferior turbinated bone touching the floor of the nose. In this manner we may account for the dangers of acute inflammation of the nares in the infant, which may become distressing and dangerous on account of interference with proper feeding and oxygenation.

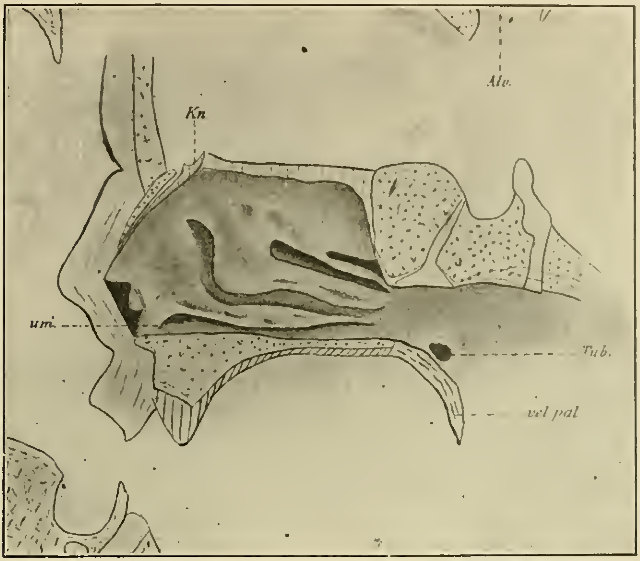


FIG. 4.

Section of a child's nasal space at the age of three years, having developed so that the maxillary portion represents one-third and the ethmoidal portion two-thirds of the nasal cavity. The mouth of the eustachian tube is on an even plane with the hard palate.

Development of the Nares.

A notable development of the nares takes place with the eruption of the milk teeth, when the superior maxillary bone, which is very vascular, increases in its dimensions, and gives rise to the formation of the maxillary sinus. At birth the body of the superior maxillary bone consists almost entirely of the alveolar process, the sockets of the teeth being in contact with the orbital plate. However, the growth of the face takes place simultaneously with that of the maxilla by the formation of spongy bone between the alveolar process and the orbital plate of the maxilla, and in this way the alveolar process, along with the teeth, become separated from the orbital plate. Coincident with the increase in the cancelous tissue upon the facial and dentary aspects of the bone, a process of absorption apparently takes place upon its nasal and orbital surfaces, which causes the formation of the sinus and the broadening of the nasal chambers. The simultaneous process of growth and absorption continues until the eruption of the wisdom teeth at about the twenty-fifth year of life, when the antrum reaches its complete and adult form.

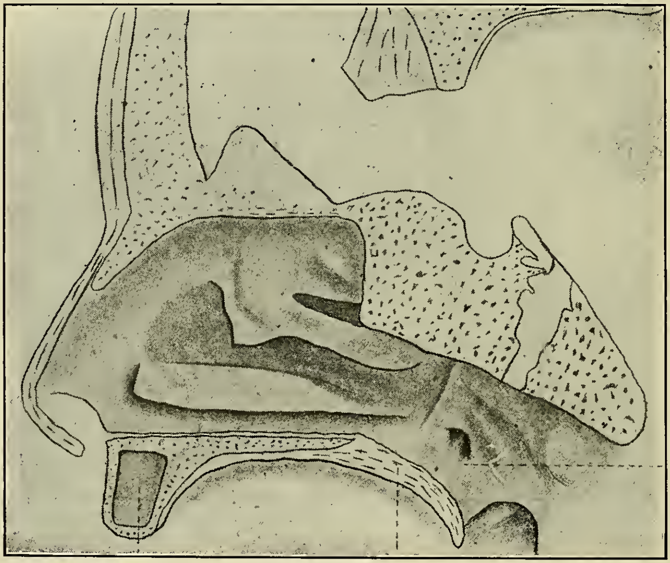


Fig. 5.

Section of child's nasal space at the age of eight years, showing that the nasal chamber has developed so that the maxillary part equals that of the ethmoidal. The palate has grown downward and the eustachian tube is above te plane of the palate.

We have said the nasal spaces increase in size by the downward growth of the hard palate. In proof of this it may be seen that in the embryo the hard palate is above the level of the mouths of the eustachian tubes, while in the newborn it lies on an even plane, and later, about the eighth year, considerably below it. The nasal space is lengthened by the growth of the plate in the antero-posterior direction, and by the development of the alveolar process, which affords space for three molar teeth, and which has its beginning near the seventh year, to be completed at the time of full dentition. This development of the nasal spaces in the antero-posterior direction pushes the maxillary bones forward and causes the orthognathous face of the child to assume the more prognathous form.

Development of Head and Face.

The head and the face grow more rapidly in two periods. The first from birth to the eighth year. The second period begins at puberty, or at the fifteenth year, when the head and face develop in all directions alike, and are completed in the female about the nineteenth year, and in the male at about the age of twenty-one. During the intervening period, from the seventh to the fifteenth year, much less growth takes place. The development of the child's face may be divided into three stages. During the first year the examination of the head and face is general, but the face gains distinctly on the cranium, more especially in the lower nasal cavity. The second stage is ushered in at the second year, to continue to the fifth year, when the face grows more in breadth. From the fifth to the seventh year the face grows more in length, while the nose develops chiefly in the lower region. The hard palate, forming the floor of the nose, descends to increase the dimensions of the space above. At birth the hard palate, if prolonged back, would strike near the junction of the basilar process and sphenoid. At the age of three it has grown downward to strike near the middle of the basilar process, and at the age of six it may be seen on the plane with the edge of the foramen magnum, which is nearly the relationship of the adult palate. The choanae likewise exhibit changes indicative of palate descent. At birth the height of their cavities is about six mm., and the breadth a little more. At the first year it has doubled, at the second year its height has increased more rapidly and has changed from a circular to an oblong channel; at the seventh year its perpendicular axis is twice the length of the horizontal, and has assumed at this early time the relative adult form.

Nasal Obstruction.

From the foregoing we conclude that at about the eighth year the structures have practically assumed a permanent form, and it may be said that up to this time the child has been predisposed to nasal obstruction, due to the process of physiological growth, and most especially at the period of eruption of the deciduous teeth and first permanent teeth. At about the fifth year the third tonsil is beginning to assume larger proportions and threatens to close entirely the narrow nasal lumen. Those children having a spacious nasopharynx, such as those descended from the brachycephalic type, with platyrhinnic noses, and the mesocephalic type, are less liable to nasal stenosis than those who have ancestors of the dolychocephalic head, with the laptorhinnic noses. In fact, the latter class always suffer more or less, and are the most frequent visitors to the rhinologist and the orthodontist. They have inherited a type of facial structure called the leptoproscopic, which is a narrow and long face, with high and thin nose, small orbital cavities and accessory sinuses, small nasal chambers, and a high-arched palate and limited alveolar processes, in which the normal teeth can not find proper alignment. The nasopharynx appears small, and its dome, like that of the hard palate, is Gothic shape, its space is readily encroached upon by the pharyngeal tonsil. Thus we find a type of face that we are tempted to say was produced by nasal stenosis and mouth breathing. The fact is, however, that many of these have never had nasal obstruction, although from their appearance it would be the natural inference. Such patients are very prone to nasal stoppage by inflammation, and the smallest portion of the normal pharyngeal tonsil may produce complete occlusion. They have inherited a deficiently developed facial structure, predisposed to catarrhal affections, and are a type that must not be classed as having resulted from nasal obstruction, but rather as a type developed by a racial characteristic from ancestors who may have suffered for centuries from the effect of nasal stenosis and oral respiration. It may be assumed that through centuries of disuse of the nose, and the baneful effect of mouth breathing, a type of this character has gradually evolved. It is painfully true that many of this type of head and face, which is associated with a frail, bony frame and chest, become subjects of tuberculosis later in life.

Recent autopsy reports that many subjects dying of tuberculosis have suffered from inflammation of the nasal membranes, and that the majority of them had the narrow facial outline, with small nostrils and imperfect masticating mechanism. It is rare that the opposite type become tuberculous, such as are endowed with a strong and broad face, perfect teeth, imbedded in a rounded and strong alveolar process; in short, a good masticating mechanism. This type of face is usually associated with a strong osseous and muscular system and well-developed functions of digestion and assimilation. They more often have a brachycephalic head, with wide cheek bones and broad noses. On account of their spacious nasopharynx the lymphoid tissue never produces the some degree of stenosis as in the narrow face. Frequently the so-called adenoids assume large proportions in these subjects, but remain unnoticed because they have plenty of space around them. The alveolar arch has the normal circumference and the teeth arrange themselves in proper alignment, so that the function of the jaw is in full use; in consequence the muscles of mastication supply by their proper activity the requisite amount of lymph and blood to the parts for their development. These patients, when attacked with nasal stenosis, suffer less from lack of oxygen and malnutrition, and their deciduous teeth remain intact their full time. They do not suffer from premature loss of the deciduous teeth through decay, and escape the deforming effect upon the alveolar arch, which the premature loss of the deciduous teeth produce.

Influences of Heredity.

The opinion is general among medical men that heredity influences the condition which induces maldevelopment. In our country a mixture of races is in progress such as has never before been witnessed. The old Aryan race, which divided and lived exclusively in different parts of Europe for many centuries, is uniting in marriage on this continent, and the result is that asymmetry is the rule rather than the exception. According to Broco intermarriage of the long and round heads often results in deformities in the offspring. The ears and nose strongly exhibit the influence of heredity. The long or dolychocephalic head has a high and long nose, while the round-headed individual is endowed with a broad and low nose. Should a child, therefore, inherit the nose from one parent and the jaws from the other, there would result an asymmetry of the face. Thus realizing that the people of the United States constitute a composite race, we may account for the irregular structure of the face, nose and teeth of our neighbors. The purer a race is, the more regular and distinctive are its features. The prevalency of deviated septums and other anomalies that give rise to nasal stenosis may be ascribed to structural defects, due to the evolutionary changes that are caused by the intermarriage of different races in our country.

The fact that a high-arched palate with irregular teeth is usually found co-existing with nasal obstruction, has given rise to the theory that the interference with nasal respiration is the first exciting cause of this condition; and it may be consistently argued that when the function of the nose is interrupted the friction of the air currents by inhalation and exhalation can not exert the requisite stimulation to growth, and the circulation of nutrient material is lessened, so that diminished nutrition is the result. The non-use of any organ has always the consequence of either that of non-development or atrophy, and the degree of disuse of any organ determines the degree of arrested development.

Influence of Disease of Nasal Passages.

The maxilla is in no small way dependent upon the nasal function for its growth. The osteogenetic centers and resorptive process of the vascular upper maxilla will be interfered with by disuse of the nasal organs. The hard palate and alveolar arch, being limited to the growth of the superior maxillary bone, will remain too small for the proper eruption of the teeth, which remain the same in size and number. An imperfect masticating apparatus is inevitably the result, because the teeth can not come in proper apposition in an undersized alveolar arch. In a general way that palate may be considered normal when mouth breathing can be excluded, where no deviated septum exists, and when the individual has not suffered from malnutrition or rickets. A high-arched palate in the long, narrow face is a normal attribute. An abnormally low palate was found by Professor Swain, of Yale, in skulls of the Flathead Indians. This tribe of Indians have a custom of binding a board on the heads of their children with a view of flattening their heads. The effect upon the hard palate was marked, the index of its height was 33, much less than the height of the round heads, which is 46, and about half the height of the long head, which is about 60. By this observation it is revealed that the mechanical force of binding the head was transmitted through the septum, and affected the position and form of the hard palate. If it can be pushed down by such intervention it is pertinent to inquire into the forces that retard its descent. As already stated, if the nose is obstructed the stimulating air currents can not exert the proper functions upon the organ, inflammatory swellings interfere with nutrition, and the proper development is interfered with on the theory of disuse. Nasal obstruction, inherited or acquired, and its inevitable results, mouth breathing and malnutrition with deformation of the facial structure, have given rise to a symptom complex, variously termed adenoid face or lymphatic diathesis. Its indication differs according to the location of the nasal obstruction, which may be due to anterior or posterior turbinated bodies, septum deviation or spurs or adenoids. According to the degree of obstruction to respiration and malnutrition, the patient may have a vacant and pale face, open mouth, hanging lower jaw, defective and curiously toned voice, restlessness and a tendency to snore in sleep, purulent discharge, diminished hearing capacity, or recurrent headaches, associated often with undeveloped mentality, and frequent gastro-intestinal attacks. In children over eight years the deforming influence is marked by a high-arched and deformed palate, irregular eruptions of the permanent teeth and deficient chest development. It is conceivable that while heredity influences conditions which induce deformities of face, yet from what has been said about normal development, the conclusion may be drawn that it is more the result of interrupted development due to external causes, such as injuries and obstruction by adenoids. The normal growth of the face away from the skull, which is in active progress up to the eighth year, may be easily retarded by disturbed metabolism, by disuse of the function of the nose, and by the diseases occurring secondary to nasal obstruction and mouth breathing. The consequent faulty apposition of teeth prevents the proper function of mastication, another important cause of retarded growth of the jaws. The associated mental defects in case of nasal obstruction are due to stasis or lymph in the meningeal membranes, which may be ascribed entirely to mechanical causes, for upon removal of the obstructing adenoids, the congested lymph channels disappear, and with it the headaches and mental depression. Early attention to malnutrition, and removal of obstruction when first seen, will favor a normal development, and save the child from the stigma of mental and physical degeneracy. We believe, however, that above designation by evolutionists is unfortunate, because these malformations affect the frame of the face and head, and very remotely, if at all, the brain.

Constitutional Effects of Nasal Stenosis.

The constitutional effects of nasal stenosis and oral respiration are often seen in defective chest development. While it may be possible to obtain sufficient air through the mouth for oxygenation of the blood, yet by this process of breathing the chest muscles are not sufficiently engaged and are always retarded in their growth. The chest is found sunken and flat, and the muscles furnish only sufficient power for shallow respiration. The inspiration and expiration are less full than in the subjects who breathe through the nose. The paleness of the face is partly due to the faulty action of the muscles of the chest, for the ribs are not sufficiently elevated to permit the air to enter, and bring about proper oxygenation. The thoracic mechanism failing, the diaphragm and abdominal muscles are depended upon for aeration, which are insufficient. In consequence certain blood changes take place, such as a diminished number of red corpuscles, increased number of the white, and the production of some abnormal blood cells, known as lymphocytes and macrocytes.

Treatment.

In closing we may briefly mention what treatment is indicated to prevent deformities and arrest of development. It is mainly to remove nasal obstruction and malnutrition. A vicious circle is created by nasal stenosis, compelling oral respiration, resulting in an infection of the air tract, the aural cavity and gastro-intestinal tract, which ends in malnutrition and deformation of the facial structure. Faulty metbolism may likewise initiate the process, to be later followed by nasal stenosis. The masticating mechanism becomes faulty through malocclusion. The respiratory function is lessened, and chest remains undeveloped, and such subjects grow up with little resistance to the infectious diseases, frequently becoming tuberculous. Treatment consists in removal of obstruction to nasal respiration by hygienic or medicinal treatment, and by surgical methods. Nasal stenosis should be corrected at time of first appearance at any age; the best results are obtained early in life or during the period of development from the first to the sixth year, or before ossification has set in. If the palate fails in descent and teeth erupt irregularly, correction by an orthodontist should be resorted to as early as possible, beginning even with deciduous teeth in order to assist the normal development of face, palate and teeth by mechanical means.

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Discussion.

Dr. Milton C. Watson, Detroit.

Dr. Hartz has discussed for us to-day the development of the internal face, and the influence of nasal and post-nasal obstructions upon the development of these parts. I think we can not fail to be impressed with the thought that the only logical conclusions that can be drawn from the facts he has presented are, that there is, beyond any question, a close relationship between the development of the tissues with which we have to deal directly, and those of the nasal region; and that the greatest possible influence for good must come from the early correction of malocclusion of the teeth.

The exact relative importance of mouth-breathing, malnutrition, improperly exercised masticating function, and lowered vitality, as primary or secondary factors in the production of malocclusion, is hard to determine; however, they are all factors that must be reckoned with if we attain our greatest usefulness in the correction of oral deformities. If by any chance later investigations should show conclusively that the primary cause of malocclusion is of an hereditary character, we would still be under obligtion to consider all the above-named evil influences, for they would still be secondary factors at least. Regardless of whether nasal occlusion is a primary or a secondary factor, it must be apparent that a confirmed mouth-breather can never properly masticate his food because he needs his mouth for breathing purposes, and that failure to perform this function will have a twofold effect, one bearing upon digestion and nutrition, the other upon the lack of development due to disuse of the jaws. The lowered vitality of an individual who is not receiving a normal share of oxygen must also be granted a place of prominence in the list of evil influences, so, to my mind, the active care of these cases will not change greatly, even though the relative importance of various etiological factors may eventually receive more or less prominence than we now accord them.

The first period of active growth of the nasal region is from the first to the seventh or eight year, so we are told, and this being true, we surely can not fail to appreciate the fact that the greatest good must come from very early attention, even at three, four or five years of age. This will produce the greatest possible stimulation to a more active nasal development, thus relieving, to a degree at least, the general systemic evils dependent upon nasal stenosis. The stimulating effect of orthodontic interference extends to all tissues adjacent to those actually operated upon, a fact still disputed by some, but one generally accepted by most thoughtful observers. If advantage is taken of the possible increased masticating capacity after occlusion has been restored, the renewal of this function will have a persistent stimulating effect tending to bring about renewed nasal development; thus the relationship and interdependence of the rhinologist and orthodontist becomes apparent.

The binding of a board on the top of the head of children of the Flathead Indians probably influenced the development of the palatine portion of the maxilla, because the bandages were wound about the mandible, pressing it hard against the maxilla; though if it can be determined that the bandages were not thus applied, then the fact becomes one of importance, because if any outside influence affecting the development of the cranium affects also the growth of the maxilla it is more than probable that outside influences directly affecting the development of the maxilla might also react unfavorably upon the cranial development.

The essayist's position in regard to the perverted influence of the tongue in mouth-breathers is, I believe, well taken, for under normal conditions it exerts not only a persistent, but a pronounced stimulating effect. This is well illustrated by the excessive development of the jaws and the wide spaces between the teeth of patients who have an unusually muscular tongue.

Dr. Hartz referred to hereditary influence, and mentioned incidentally the large nose and the long face of two radically different types. I happen to know, from many conversations with the Doctor upon this subject, that he does not believe such conditions ordinarily result from the intermarriage of different types, but the very fact that it does at times occur must be explained before we can say that children *never* inherit certain anatomical characteristics from one parent which are out of harmony with certain other anatomical features like those of the other parent.

This society, as a whole, has heretofore credited heredity with a very unimportant place as an etiological factor in the production of malocclusion. I can not help but feel that this position has been an extreme one, and that eventually further investigation will reveal its importance.

Dr. Burt Abell,
Toledo, Ohio.

It has occurred to me that the depth of the inhalation must be influenced directly by the orifice through which the air enters. A given quantity of air passing through a smaller orifice would require a greater length of time. In nasal respiration, the orifice being smaller, there is a greater pull of the respiratory muscles in the effort to get the requisite amount of air. This effort gives tone to these muscles, and deepens the respiration. The deeper the respiration the greater the amount of oxygen, and the better the tone of the whole body.

In 1885 Zeim performed the laboratory experiment of stopping permanently one nostril of young animals, and found that there was a corresponding lack of development on that side of the head. Collier, in London, tried the same experiment, stopping both nostrils, and found the lack of development was bi-lateral. When we take into consideration that there are twenty-five thousand struggles for breath in the course of twenty-four hours in a bad case of adenoids, and this not for one day, but for days and months together, with no relief, we begin to see why there is the worn, tired expression we see so often in these cases. Yet I believe we have not placed enough emphasis on the one factor in these results that is of paramount importance. When the child is asleep there is a constant action of the sub-conscious brain, opening the mouth, operating the muscles, etc., through the reflexes, all operating in an unnatural way, overworking this brain. There is brain fag, so to speak. How can the child be bright mentally? It is taxed beyond the fatigue limit all the while.

After examining a great many skulls of the aboriginal races, in which he found scarcely any malocclusion, Catlin says if he were to attempt to bequeath to posterity the most important motto human knowledge could convey it would be told in three words, "Shut your mouth."

Dr. Varney E. Barnes, Cleveland, Ohio. I was much interested in Dr. Hartz's paper. I noted particularly his remarks regarding growths in the nasal passages occurring between the ages of one and seevn years—and then the stoppage until about sixteen years of age, if I understood him correctly. Therein lies the key to malocclusion of the teeth, I think. I have been observing very young children for five or six years now—seeing many of them at birth, and noting in most of those instances the healthy condition of the child and its mother. The children suffering from these troubles are almost invariably "bottle babies," and have suffered from malnutrition. The air passages are deficient. Nor do you find proper growth spaces between the incisors, cuspids and temporary molar teeth.

The remarks of Dr. Watson that we should consider malnutrition, heredity, abnormal breathing, etc., all as factors, seem well taken. We may have a predominant factor, of course, which operates until the cycle is established, working against the child more and more as time goes on.

My observation has been that all of these irregularities of any consequence are shown in the temporary teeth. All of them.

Dr. Ottolengui. I suppose we all agree that nasal obstruction and mouth-breathing are factors in the production of malocclusion. I call your attention to the fact that in explaining how the mouth-breathing produces malocclusion, we have heretofore heard more about the influences of malevolent forces—depression of the jaw, muscular pressure, etc. Thus it has been explained mainly along mechanical lines. I do not deny any of these causes, but it seems to me the more important point is that the poor breathing contributes to malnutrition, and the latter to a lack of development of the parts.

There is a paragraph in the essayist's paper to the effect that if an arch is undeveloped, the large teeth growing into it must necessarily come in crowded. That, gentlemen, is quite different from inheriting a small jaw from one parent and a large set of teeth from the other. You would find such a case difficult to correct. But when normal development is checked by prompt and early interference we may re-establish development and produce the full size of arch which that individual should have had.

I take issue with the essayist on one point. It does not seem to me that the fact that a deflected septum has been found in an embryonic fetus proves heredity. If so, then all congenital faults are inherited, because all physical defects found in a newly born babe must have existed in utero—such as cleft palate, for instance. I can not believe very much in the heritage of actual deformity.

Dr. Henry J. Hartz. In reference to the finding of deformed septums and spurs in the embryo at the sixth month, one of our best embryologists and anatomists, Professor Mihalkovics, of Budapest, reported having noticed them. He did not say how they were produced, whether by injury of the embryo, or by inheritance from ancestors. No one can tell. Dr. Abell spoke of nasal respiration affording better chest development. It is unknown to me how the additional pressure is obtained, that can not be had by oral respiration. Rhinologists are beginning to appreciate the work of the orthodontists more and more. On a recent trip to the East I noticed that their interest is aroused and more mutual. The claims of the orthodontists that they can enlarge the nasal space by mechanical means is not quite admitted, although the theory that by stretching the arch the palate is assisted in its descent appeals to reason. Careful measurements would decide the matter. The co-operation of rhinologists and orthodontists will accomplish much for humanity in correction of faulty nasal respiration and imperfect mastication. The correction, however, should be undertaken during the early development period. The broadening of the child's face takes place principally during the age of from two to five years. Any obstruction in the nasal region at this time would have a tendency to prevent the normal growth, and a more or less narrow face is the result. In fact, the entire face is retarded in its proper growth by the failure of the respiratory function of the nose. The diseases produced by mouth-breathing aid in the arrest of development, especially by the catarrhal and the digestive disturbances. I think the obstruction should be removed as early as possible, and hygienic and medicinal measures instituted to prevent malnutrition. The family physician is usually the first to see the difficulties in the child, and I propose to spread this new knowledge of orthodontia and rhinology in the medical societies.

I believe stenosis of the nose and mouth-breathing is the first etiological cause of malocclusion, the two factors working together, inducing a limited maxilla and palate, in which the teeth can not normally find place. It is conceivable that malnutrition might initiate or work at the same time in maldevelopment of the facial structure. Through faulty metabolism, either during embryonic existence or later when bottle fed, the child's blood stream may abound with imperfectly oxidized food, irritating in nature, which sooner or later begets an increase in the size of the turbinated bodies of the nose and in the tonsils. Such children are said to have inherited a rheumatic diathesis, and sometimes have large tonsils at the first or second year. In conversation with Professor Kilian, of Freiburg, a noted authority, I was impressed with the etiological difficulty of this subject. He seemed inclined to the belief that nasal stenosis and oral respiration were the paramount factors in the production of these deformities; but he also believed that inheritance plays an important predisposing role.

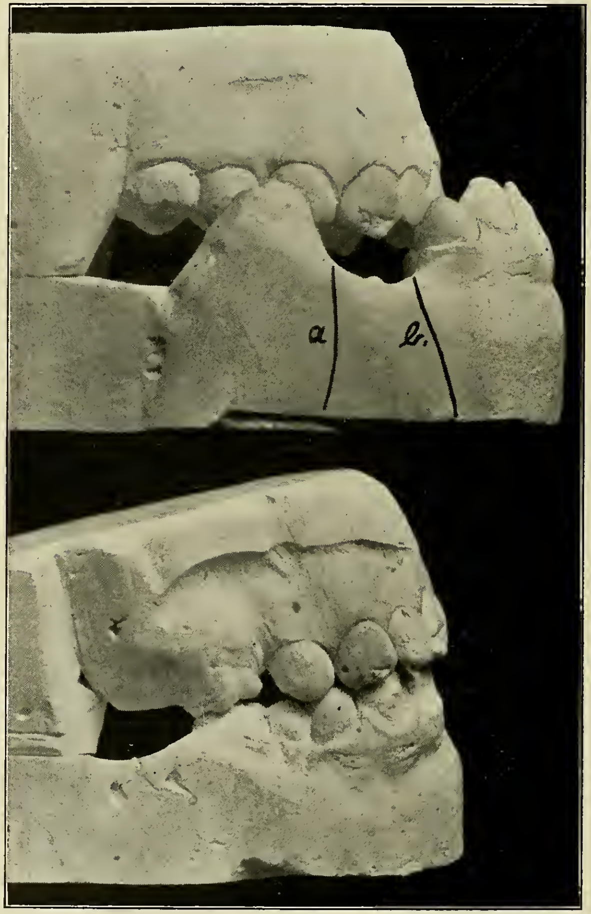
Double Resection for the Treatment of Mandibular Protrusion.

By Max Ballin, M.D., Detroit, Mich.

Mr. H. A. M., a young man twenty-two years old, consulted me first on May 10, 1907, complaining about the protrusion of his lower jaw that caused him a great deal of trouble, and for which dental treatment, tried from early childhood to this day, had been of no avail. He was very much embarrassed by his deformity, mastication being practically impossible, and speaking being rendered very difficult. The knowledge of his deformity kept the young man from society and made him of rather melancholic disposition.

On examination I found an otherwise healthy young man, whose lower incisor teeth protruded to such extent that the distance between upper and lower incisors measured half an inch. The teeth were very defective; the incisors, two canines, one premolar and only one molar were present on the lower jaw. On the upper jaw the incisors, two canines and two molars were present. On the lower jaw there was a big defect between the premolar and the molar on each side. The alveolar process was quite atrophic at the place of this defect (see Fig. 1).

The teeth, the incisors especially, were grooved on their crowns, so-called Hutchinson teeth. There is nothing in the family history of the young man that can be made responsible for this condition of the teeth, the same probably being only due to non-use, caused by protrusion of the mandible. At first sight one can see that in this case, as in most of the kind, the condition is due to sub-development of the maxilla; as you see the upper jaw is very small and the palate is very high. You also notice that the teeth are very sparingly developed in the upper jaw, as stated above, only twelve being present. The size of the mandible must be considered normal. The development of the upper jaw has been arrested, and hence the protrusion of the mandible is due to sub-development of the maxilla.



FIGS. 1 AND 2.

FIG. 1.—Model taken from patient before operation. *a* and *b*, lines of resection.
FIG. 2.—Model after operation.

Mainly on account of the melancholic disposition of the patient caused by his deformity, and also on account of practical reasons, mastication and speech being interfered with by the deformity, double plastic resection of the jaw was proposed and readily accepted. I consulted my friend, Dr. Jackson, a doctor of dentistry and medicine, who made the model and also fitted the necessary appliances to the teeth to keep the fragments of the jaw in good position after the operation. It is mainly due to the skill and valuable suggestions of Dr. Jackson that such good results have been accomplished in this case. Previous to the operation, Dr. Jackson cleaned the patient's teeth and fastened Angle's fracture clamps to the premolars and molars on both sides of the mandible; that is, to the teeth between which the resection of the mandible was to be made.

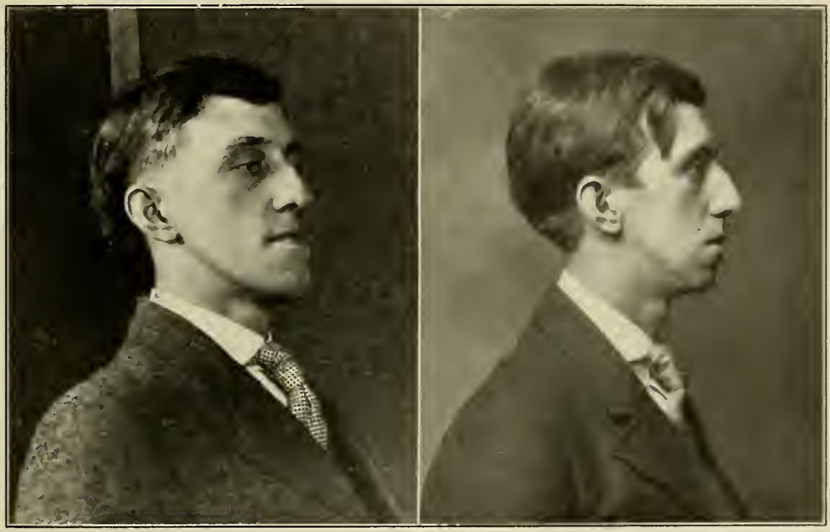


Fig. 3. Fig. 4.

Figs. 3 and 4.—Photographs of patient before and after operation.

The Technique of the Operation.

The operation was performed on May 20, 1907, at Harper Hospital. Ether was administered and the incision made on the lower edge of the jaw. The soft parts were detached, and by means of a curved elevator the mucous membrane was peeled from the alveolar process without opening the oral cavity. Then a trapezoid shaped piece was resected from the mandible. The same was repeated on the other side of the jaw, so that practically on both sides the piece between molars and cuspids was removed (see Fig. 1). The base of the removed piece was somewhat larger than the apex; the base measured about half an

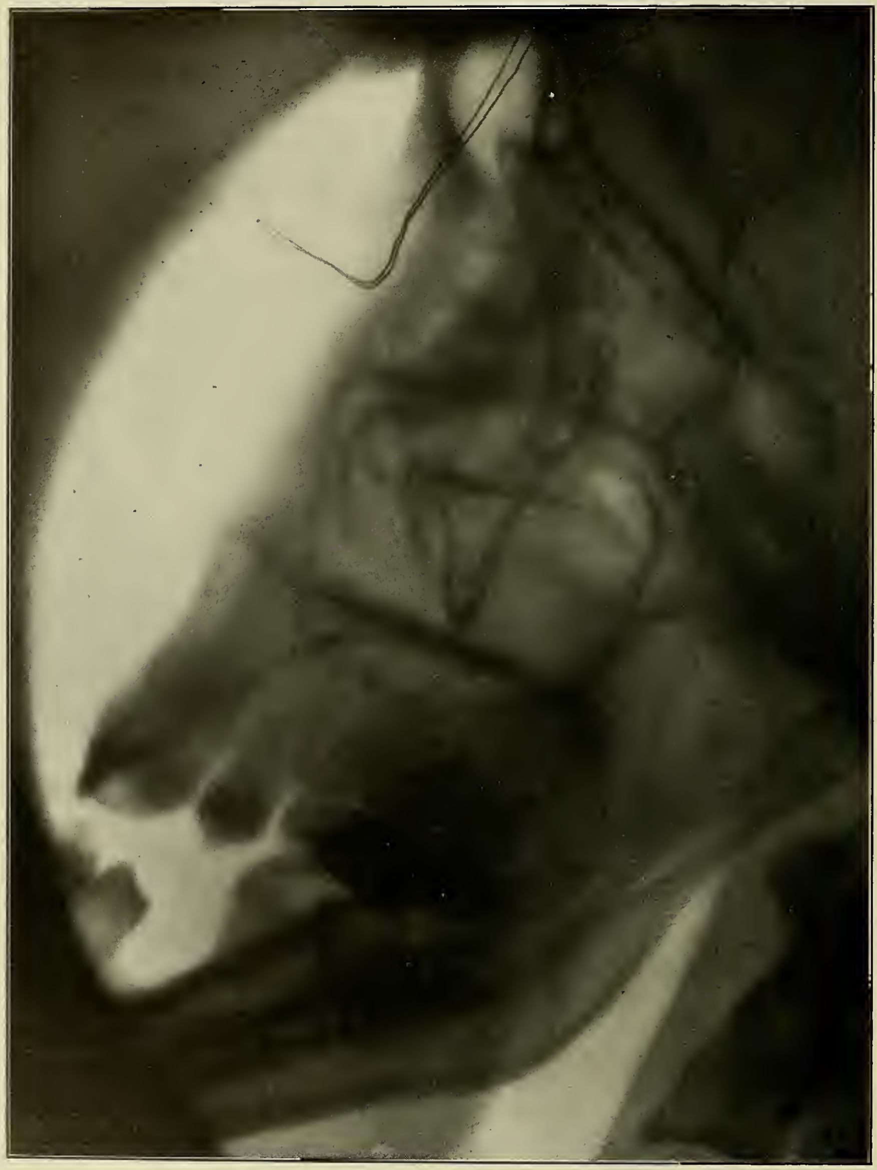


FIG. 5.

FIG. 5.—Radiogram before operation. The protrusion of the mandible reached over the photographic place; still the radiogram will give a good idea of the disproportion.

inch. The anterior fragment was easily adapted to the posterior. Two drill holes were made in their lower edges, and the fragments were fastened together with silver wire. The wound was sutured. After this the union of the fragments was made more secure by wiring together the fracture clamps, which Dr. Jackson had applied. This last was the first hand of a surgeon which entered the oral cavity during the operation. Before this act the whole operation was performed outside of the mouth, great care being taken, as I have mentioned, not to penetrate the mucous membrane in detaching the soft parts and in sawing. As to the technique on the first side, I used a saw driven by an electric motor, the same as I use for trephining. On the other side I excised the piece with the old style chain saw, leading the same round the mandible with a Dechamps aneurysm needle. I must say that the second method is preferable. The chain saw method took two minutes, and the electric saw method much longer, and it was very hard to saw in straight lines. Besides this, the electric so-called ripsaw easily causes burning of the tissues.

The patient made an uneventful recovery, and left the hospital after about a week. The wound healed by first intention, and I can demonstrate to you the result on the gentleman himself, and by the accompanying pictures (see Figs. 1-5).

After the patient left the hospital it was seen that the lower and upper teeth would not come into contact. Again Dr. Jackson helped the young man through this trouble by grinding off the crowns of the molars. This, by the way, could have easily been detected before the operation with the aid of the X ray picture, which shows clearly that the lengths of the molars would prevent contact of the incisors, even after shortening of the mandible (see Fig. 5). This shows the importance of having a good X ray picture taken.

The result, as you see, is a very favorable one. The patient's facial expression is very much improved, and the young man, who formerly was shy and kept away from society, I am told, is now a favorite with young ladies.

Conclusions.

In conclusion, I would like to mention a few points in the technique of this operation. In the first place strict asepsis should be a condition without which successful work is impossible. Therefore, opening of the oral cavity during the operation should not occur, as this would certainly lead to suppuration and non-union of the bones. In our case opening of the oral cavity was easily prevented, as we had no teeth to encounter at the point of resection, therefore, the mucosa over the alveolar process could be easily detached without injuring it. If the teeth are extracted during the operation, communication between the external incision and the extraction wound will always take place. I would recommend, therefore, to extract the teeth, necessary to remove for the resection, first, and then wait some months until the extraction wound is completely healed and atrophy of the alveolar process on the place of extraction has taken place. Then the surgeon can proceed, as in our case; that is, excise a piece of the jaw without entering the oral cavity; second, a chain saw led around the mandible by a Dechamps needle is the best instrument for resecting a piece of the jaw; third, the detached parts of the jaw are best kept in place by wiring through the mandible and again by wiring together the teeth next to the place of resection by means of Angle's fracture clamps. The so-called sectional splint, also invented by Dr. Angle, of St. Louis (*Dental Cosmos,* April, 1903), seems to me not practical. This splint is made before the operation, and consists of five sections, two of which correspond in size to the two parts of the jaw to be removed. After removal of these parts, the intermediate sections of the splint are removed and the remaining parts are supposed to fit into each other. Theoretically, this is a splendid suggestion, but, practically, there is no surgeon and no saw that will excise a piece of the jaw in such an exact mathematical way that the two parts of the splint would just suit each other. We have to make our splints to fit the excised jaw, and not excise the jaw to suit the splint.

The result in our case will permit the suggestion that double resection of the jaw, with proper aseptic precautions, can successfully cure exaggerated protrusion of the mandible if orthodontic treatment has failed. This is one of the operations where the combined efforts of the surgeon and dentist will lead to success.

Discussion.

Dr. H. A. Pullen.

I assure you it has been a great treat to me to hear a clinical talk of this kind by so eminent a surgeon as Dr. Ballin has proclaimed himself to be by the results attained in treatment. It is the first time in the history of The American Society of Orthodontists that such a clinic has been given, and we are glad to have such a record as the work which has been done so successfully for its kind as shown this morning. Regarding the technique of the operation there are two ways of looking at this matter, as Dr. Ballin has said, from the surgeon's and the orthodontist's standpoint. The orthodontist's standpoint, perhaps, has been a theoretical one, because his training has not been along the line of such operative surgery that he could do the operation with the same ease that Dr. Ballin has. However, the orthodontist does believe he could suggest a little in theory, and perhaps in practice, to the results attained here; or perhaps he might treat the case without the surgical operation. Now we, as orthodontists, do not pretend to tell the surgeon anything that is new to him, but there is no doubt that the medical profession can profit by suggestions from the dental profession, and *vice versa*, and by this co-operation we will further and better our practices and benefit humanity thereby.

In the case the doctor has presented to us this morning, the technique of the operation has appealed to all of us. We want to know more about it so as to be able to speak with absolute authority with reference to these operations. We want to see more of them.

The objection which Dr. Ballin presented to the idea of accurately measuring, or rather sawing, these sections, and applying a splint measured exactly for the space, may be well taken from the operator's standpoint. I admit from the orthodontist's standpoint it has been somewhat theoretical. But I do believe we can arrive at a little more exact idea of the true relations the jaws should be in after the operation, by some measurement at least. I do not know whether the doctor in this case made any measurements, or whether the dentist made any measurements. I would like to have the data, because it is interesting to us. The orthodontist is measuring spaces and distances every day, and the idea that these measurements might be left out, to him might seem unfeasible, and perhaps a little impracticable.

This case represents more to us than Dr. Ballin realizes. It means that the medical profession, and the dental profession co-operating with them, have achieved success in more than one case of this kind; but here is a case which we have been enabled to see with our own eyes, and determine the exact result accomplished, and it is the first time in the history of a dental society where those results could be publicly observed. These cases have been written up for dental societies, but no one except the operators and a few friends have seen the operations or the actual results.

There are some questions we want to ask. We have always wanted to know, in the technique of the operation, what was done with the inferior dental artery, and the exact cutting that was made through the harder and softer portions of the bone.

In regard to the technique of the dentist's part of this operation we have a few kindly criticisms to offer. We prefer that impressions for casts and models be made with plaster of Paris rather than with compound, because we can then more accurately determine the exact relation between the arches before and after the operation. Impressions taken with compound so stretch out of shape that measurements are not at all accurate, in case they are wanted.

As to the possibilities of restoring the normal relation of the jaws without operative treatment by this method of resection of the mandible, the orthodontist perhaps has had experience with which the general surgeon may not be familiar with reference to these extreme cases. There may not be many of them, but they are numbered throughout the country by the dozen at least, where I think cases of this severity have been restored to normal by restoring the spaces where teeth have been extracted, and inserting artificial dentures and bridge work, thus restoring the normal number of teeth in both arches, and at the same time restoring the balance of the face, even though it may be a little unusual at this age.

So far as the condition of the patient at present is concerned, the orthodontist has this suggestion to make, that a little orthodontic treatment might still be done on account of the loss of the bicuspid tooth on the right side above, obtaining spaces and restoring teeth, thus securing a more normal relation.

It is interesting to us to see an operation of this character performed without opening into the oral cavity. It is a new thought to me that we thus get rid of the possibility of septicemia. Septic material may thus be kept from the wound, and healing by first intention is thereby favored.

I would ask the doctor to repeat again the manner in which he took care of the apparent excess of soft tissues of the periosteum, mucous membrane, gum and muscular attachments which would seemingly be present and might interfere with uniting the two sections of the mandible.

I want to thank the essayist for the contribution he has made to the society in the report of this case.

Dr. Henry Baker. Dr. Ballin has certainly given us something interesting in the line of surgery, and I am of the opinion that it is an operation that very few surgeons would undertake to perform, and Dr. Ballin deserves great credit for performing such an operation without leaving a scar, although this may be due to its healing by first intention.

While I have great admiration for his work from a surgical point of view, I must disagree with him as to its being the best method to correct this case. I can not help but think that we could get better results by orthodontic treatment. There have been many cases quite as extensive as this one that have been successfully corrected without the loss of any teeth, which, to the true orthodontist, means a good deal. On the other hand there have probably not been a half a doezn operations of this nature ever performed. To go back a few years before the introduction of the Baker anchorage the orthodontists would consider it an extremely difficult case to correct successfully on orthodontic lines, while now it is almost an every-day occurrence.

Dr. Ottolengui. It seems to me there are two important features about this paper which I would like to emphasize. The first is that we have been taught that a mandible may be too large—so much so that the only treatment would be by surgical interference. So far as I know, we here have the first success of surgery in the operation such as has been recommended, and the surgeon starts out by telling us the mandible was *not* too large. He admits that the over-development of the mandible is so rare that it is scarcely necessary to take it into account in our ordinary work. I will not deny that this result has excused this operation, but the resection of a portion of a mandible which is of normal size in order to make it fit an upper arch which is under-developed, is analogous to the extraction of two upper teeth to make the upper arch harmonize with a lower arch which is too small. As a general principle, this operation could hardly be countenanced. It is to be accounted as useful only in cases of extreme need, and not in ordinary circumstances. The very success of the operation is its danger. There is already the mental impression in the mind of the operator looking to further operations of the same kind. Before we had so many operations on cleft palate cases the surgeons wished the self-gratification of doing the operation, but if the condition could be remedied by other means it would not be fair to operate.

If the mandible is normal an effort should be made to put the abnormal part (in this case the maxilla) right, thus making the abnormal fit the normal. I protest against this operation as a reasonable one for future work, except it be in the rare cases of over-developed mandibles.

The other point of interest is, the wholly external character of this operation. By keeping the internal tissues intact Dr. Ballin has prevented infection from the oral fluids. For this he should have a great deal of credit, and I hope he may write this up fully and illustrate it thoroughly so that we may make a record of credit to him, to us and to surgery.

Dr. Dodson. Dr. Ottolengui speaks about the maxilla in this case being under-developed. I do not think it is under-developed at all. And then he speaks of the mandible as not being over-developed. I think it is. I have never seen a case of this kind where the mandible was not over-developed, and sometimes it is beyond any argument whatever. Where there is little or no normal use made of the mandible, there is at times, for some reason, a tremendous development of the chin.

Dr. Ottolengui. I would discriminate between an excessive development of the chin and excessive development of the mandible.

Dr. Dodson. I mean the mandible always, which, of course, includes the chin.

Dr. Max Ballin. Several questions have come up during the discussion of this case. The first vital question is, should such cases be operated on at all? I see there is some opposition on your side, which I am not able to combat. This young man came to me with the statement that he had orthodontic treatment twice without result. I had to take his statement. I can not say the men who may have treated his case knew nothing about it. If some of you have accomplished better results I must say that I should appreciate it, but certainly nothing was accomplished in this case. So far as I know, orthodontists require a very long time for treatment. Much of the patient's time is required. This young man had to make a living, and I think the result should, because of its promptness of accomplishment, its safety, etc., be valued on those accounts. This young man would have been in the care of the orthodontist for two years, and it would have been pretty hard on his purse. Anyway, I think this operation should not be entirely discredited. We have two or three men here who perhaps can do this work. This patient thought he went to good men, and so he did not want to go to others.

I am not aware of the wonderful things you have done along this line, and I hope you may take these cases entirely away from the surgeon. That is my wish. The first operation for correction was done when the patient was seven years of age, I think, and then again when he was fifteen.

I am not able to discuss the question as to whether the maxilla or the mandible was responsible for the deformity. I have the impression it is the maxilla. Also, as to the technical part of model making, etc., I can say nothing.

As to the surgical technique, as to what becomes of the superfluous soft parts, I may say if we take away an organ and have surplus of skin and soft parts, that always disappears; it never is in the way. Nature takes care of that. We do not need to cut a particle of the soft parts away. They are taken care of.

Hemorrhage in this case was practically nil. Only the small lower branch of the mental artery need be clamped and tied. The mandibular artery is much written of; it never disturbs me. It bleeds a moment from the wound, and stops right away. This hemorrhage is absolutely not disturbing. I have done a good many resections and never had any trouble. The nerve is severed, but it does not seem to cause any anesthesia at all. The lower branch of the trigeminus nerve probably takes care of the sensitive parts.

I thank you very much for your kind attention.

A Contribution to the Knowledge of the Etiology and Treatment of Cases in Class II.

By Rodrigues Ottolengui, M.D.S., LL.D.

Adenoids cause malocclusion. This is an old story. Adenoids compel mouth breathing, and mouth breathing produces irregularity. This is the second version of the same story. In the expounding of this doctrine the various theorists have described in detail the course of events which, beginning with adenoids usually ends in malocclusion, and there has been a remarkable unanimity of opinion. Two main factors in the production of malocclusion have been recognized; arrest of development, and adverse mechanical forces during the eruptive period. I shall not antagonize any of these theories, speculative though they be, but I beg your indulgence while I tell the same tale with the accent in a different place.

Coming at once to a discussion of that class of cases with which my title specifically deals, what is the accepted doctrine as to the etiology of Class II conditions, otherwise known as distal occlusion? It is that nasal obstruction, most commonly adenoids, causes mouth breathing; that this in turn induces an abnormal lateral pressure from the cheeks against the erupting teeth, thus narrowing the arch, which is the more readily accomplished because the drooping mandible takes the tongue away from its normal place against the vault. Incidentally it is mentioned that "the mandible is drawn back and fails to develop."*

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* Angle. Malocclusion of the Teeth, p. 113.

Malnutrition a Cause of Malocclusion.

From the orthodontists of the world I now ask serious consideration for the following proposition:

Malnutrition causes malocclusion.

Malnutrition is a special cause of malocclusions of Classes II and III.

The permanent teeth do not displace those of the primary set but erupt into a larger, and what is more important, an entirely different arch, and the bony process is new bone built about them during the eruption. Grant this hypothesis and it is evident at once that, if during this period of transformation there be an interference with normal functions there may and probably will be a lack of bone building nutriment. What will result? The permanent teeth, all larger than their predecessors, erupt into the same small arch which the temporary teeth had occupied, or into one insufficiently enlarged, because of insufficient nutritive elements. Thus the irregularities of the teeth, and the consequent malocclusion, will be in nature and degree constantly related to the extent and time of the disturbance in nutritional functioning. I am aware that this is not new. I know that it has been recognized and said before. Yet it seems to me that even with the most modern of orthodontists it has not been given that prominent place which it should occupy. For example, in connection with my subject, Class II cases, while all take into account the two causative factors which I have already named: (A) Lack of development, and (B) Adverse mechanical forces operating during the eruptive period, it is the second cause which has received the most attention, whereas, as related to treatment, it is the first which is of the gravest importance.

What is the common course? "Madam, has this child had its adenoids removed? No? Well, they must be removed before I begin my work. Your doctor thinks she is too nervous for an operation at present, and you wish to postpone it for a few months? Very well, we will postpone the regulating until after the operation, because we can not hope for a permanent result in the presence of adenoids."

"Adenoids! Adenoids! Adenoids!" What a cheap exhibition of scientific attainment this cry is! How easy to impress a patient thus with the acuteness of our diagnosis, and the accuracy of our treatment. And yet this dogma is erroneous. The cure of the adenoids, however important, is not the most essential step in the treatment.

The chief factor in the vast majority of Class II cases is the deficient development of the mandible. Let us relegate adenoids and other nasal obstructions to a second place in our thoughts, and examine first as to whether the mandible is undeveloped. What influence will this have?

The corrollary is that the sooner the obstacles in the way of development of the mandible are removed, the more perfect and the more permanent will be the results of treatment.

Dr. Angle's Theory.

What is the explanation of distal occlusion of the lower arch? Angle in the seventh edition of his "Malocclusion of the Teeth" discusses this subject. As the most recent pronouncement I may quote it here. He says (pages 115-16):

"It is easy to understand the beginning of malocclusion of the teeth in this class of cases, and the various stages are readily followed. At the time of the eruption and locking of the first permanent molars which marks the true beginning, the condition for the mal-locking of these teeth is most favorable. The occlusal surfaces of the crowns of the deciduous teeth are comparatively flat, their cusps having largely disappeared so that they can no longer exercise much control over the proper relations of the jaw when closed. The mandible instead of being held forward by the cusps in their locking is allowed to close more or less distally to normal." . . . "So, as the first permanent molars erupt and the cusps feel their way into occlusion, the lower molars may erupt in distal occlusion, not always in full distal occlusion at once, for very often only the minute points of the cusps touch for some time, as if hesitating which side of the planes of the cusps they will follow. Probably only a few hours in many cases decides the position they will ultimately assume, whether it shall be normal or abnormal, but when once established their course is progressive until their full normal or distal occlusion ultimately takes place."

It will be noted that this doctrine fixes the beginning of distal occlusion at the time of the eruption of the first permanent molars, although later in the work Dr. Angle records Dr. Mendel's case and admits that distal occlusion may exist in the deciduous denture, which, he says, "is not remarkable since nasal obstructions from adenoid growths are often well defined at two or three years of age."

I will not dispute the fact that distal occlusion of the lower arch may occur as Dr. Angle describes, but that the above is the sole explanation is most doubtful. If we consider analytically that part of the theory where the erupting lower molar is "feeling its way," while we may admit that it may erupt into distal occlusion, Dr. Angle does not tell us why it ever does. Personally I can not believe that normal or abnormal molar occlusion can be due to casual activities, operative during only a few hours. On the contrary, I think much more persistent causes for distal occlusion are at work.

For example, Dr. Angle admits, and we all know, that there may be distal occlusion of the lower arch in the temporary teeth. In such instances, presuming that the malocclusion be not corrected, the first permanent molars are compelled to erupt in distal occlusion, which often is more pronounced in the permanent than in the deciduous set, for the reason that the inclined planes are more powerful.

Subdivision Cases.

Dr. Angle recognized the necessity of explaining the subdivisions of Class II, where the distal occlusion is unilateral, and he advances two hypotheses. He points out that the eruption of the teeth in the two lateral halves of the jaws are rarely simultaneous, and intimates that mouth breathing may produce distal occlusion on one side, and may be overcome prior to the eruption of the molars on the other side, thus permitting normal occlusion on that side. The alternative hypothesis is a curious one. He says: "The majority of such cases are, however, in the author's opinion directly traceable to the premature loss of the upper first or second deciduous molars, or even of teeth anterior as may often be noted."

In connection with the first theory, I would point out that if asymmetrical locking of the molars is ever due to the fact that on one side the molars erupt during a mouth breathing period, which habit is overcome prior to the eruption of the molars on the other side, then it should follow that in subdivision cases, the patient should never present to us, still a mouth breather, having according to the theory already been cured of the habit.

The second theory is equally inopportune, for if the distal occlusion of one lower molar is due to the premature loss of an upper deciduous tooth or teeth, resulting in the drifting forward of the first molar, such a case would not really be a Class II case, for two reasons: First, there would be no distal pose of the chin, a characteristic always present in Class II; and secondly, the forcible movement of the upper first molar back to the place from which it had drifted, would place the case in Class I, where it really belongs.

How then are we to account for the distal occlusions of Class II. Briefly, with the word "Malnutrition." There is from whatever cause you may find, and the causes may differ in different individuals, a deficient growth of the mandible. Second, there may be a deficient development of the processes of the lower jaw, considered mesiodistally.

Protrusion in Class II.

We have in the past too often used the word "jaw" indefinitely. In the future we should discriminate between jaw and process. It would be more accurate to confine ourselves to maxillæ, mandible, and process or arch, and drop the word jaw as far as possible. For example, "protruding upper jaw," "protruding lower jaw." "What is meant?" Do the words carry the same thought to all minds? The general practitioner commonly uses the words "protruding upper jaw" for Class II cases.

Has anyone present ever seen a "protruding upper jaw" in Class II? I never have; neither in my own practice nor reported by others. I have seen more or less protrusion of the upper teeth, and let me here advance a dogma. Approximately in ninety per cent. the following will be found to be true:

In Class II, Division I, draw a circle, the circumference of which will include the incisal edges of the upper lateral incisors, then reduce the centrals to conform to that circle, and all the protrusion of that upper arch will have vanished. Of the ten per cent. of cases which will be the exception to this rule, the majority will present with the laterals really lingual of their proper place in the arch, while only a few will have the laterals really prominent. Should there be cases where the four incisors are protruding from apex to crown, they would, in my opinion, be monstrosities, and as yet I have no knowledge of any such case in Class II.

Deficient development not alone explains distal occlusion of both lower molars, but perhaps it likewise accounts for the asymmetrical conditions. Dr. J. P. Gray, at the last meeting of the National Dental Association, read an instructive paper in which he reported his discovery of many mandibles normally long on one side, and abnormally short on the other.

Distal Occlusion.

The true explanation of distal occlusion, to my mind, is the disproportionate development of the jaw which is distal to normal in relation to the profile. And here I approach with some timidity an hypothesis, *which I advance rather for further study, than for immediate and unconsidered adoption,* even though my own experience leads me to believe that it is the true solution of all those malocclusions commonly known as "protruding jaws." The theory may be tentatively stated thus:

In all cases of seemingly protruded jaws (in Classes II or III), exclusive of true monstrosities, we have distal occlusion due to deficient development. In Class II cases, there is distal occlusion of the lower teeth, due to a deficient development of the mandible, of the arch, or of both.

In Class III we have a distal occlusion of the upper teeth due to deficient development of the maxillæ, of the upper arch, or of both.

I appreciate the fact that this statement is revolutionary. If I understand Dr. Angle aright, it is the lower molar which is always at fault. According to his view the upper first molar is practically constant, mesio-distally in relation with the profile.

If this be true, diagnosis would tell us that treatment of Class II cases necessitates the forward movement of the lower arch (and mandible if possible) into normal occlusion, the upper first molars being left (mesio-distally) practically as found. Contrariwise, the treatment of Class III cases would involve the distal movement of the lower arch (and mandible if possible) into normal occlusion, the upper molars being left (mesio-distally) practically as found.

According to the hypothesis which I have the honor to present, the treatment of Class II cases would involve the forward movement of the lower arch (and mandible if possible) into normal occlusion, the upper first molar being left (mesio-distally) practically as found.

Treatment of Class III cases would involve the forward movement of the upper arch (and maxillæ if possible), into normal occlusion, the lower molars being left (mesio-distally) practically as found.

Thus the treatment of Class II is the same under either hypothesis, the seeming divergence occurring in relation to Class III, though there is a fundamental difference in both, which I may as well indicate at once. One plan recognizes the need for forcing the teeth into normal occlusion, and hoping for aid through inciting a renewal of developmental activities. The other recognizes at once that the chief trouble lies in the fact that the jaw in distal occlusion is disproportionately developed and that no mere mechanical rearrangement of teeth will achieve the best result, unless the full development of the faulty jaw can be brought about.

The one theory renders early intervention advisable; the other makes it compulsory.

If we accept this theory that apparent protrusions are really retrusions, due to deficient development, we see at once the need of early intervention, because the sooner the obstacle to development be removed, the longer will be the period between intervention and complete growth of the individual, and therefore the greater will be the advantage of reinaugurating development. Contrarily, the greater the delay prior to treatment, the greater will be the deformity due to deficiency of development, and the shorter the time for future development. This is of inestimable importance in the consideration of Class II cases, where we are to deal with a deficient development of the mandible. For example, if a mandible be locked into distal occlusion at the age of six, and if by treatment it be released at that time, then at the age of sixteen that mandible will have had ten years of unrestrained development and a normal profile will have been established, and of course will be permanent. But if treatment be deferred to the sixteenth year, that mandible will have suffered from deficient development during all that period, and treatment must be entirely different, because of the fact that so little time is left after treatment for future development, during the normal period of growth.

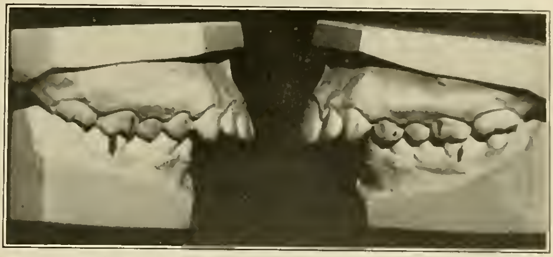

Fig. 1.

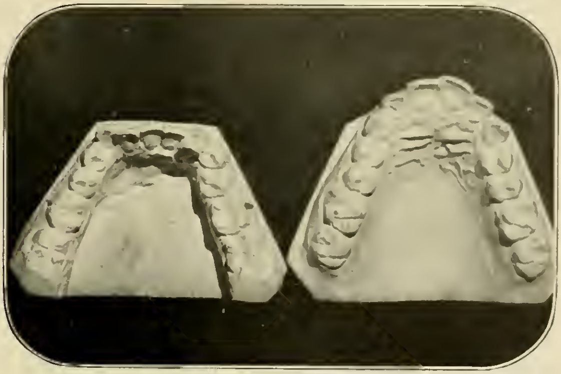

Fig. 2.

Jumping the Bite.

Dr. Kingsley long ago announced the doctrine of "jumping the bite" in these cases, but Dr. Angle has pointed out that in cases treated after the full complement of teeth has erupted, while of course the bite may be jumped, the mandible will not always remain in the forward pose, even though the occlusion may be sustained; that, indeed, the mandible may drift back distally, sliding as it were under the processes, leaving the lower arch still in normal occlusion. This is very important, and I have no doubt that it is true. Hence we may as well comprehend the fact that in *very young cases* we may really jump the bite, which

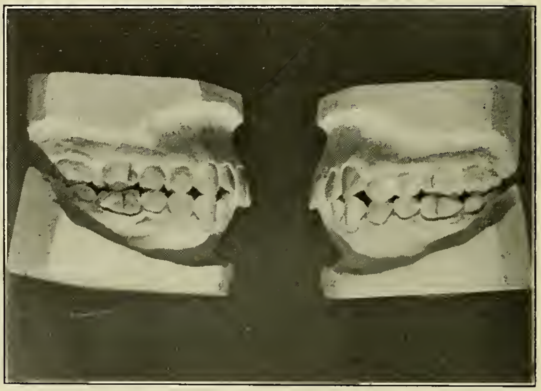

FIG. 3.

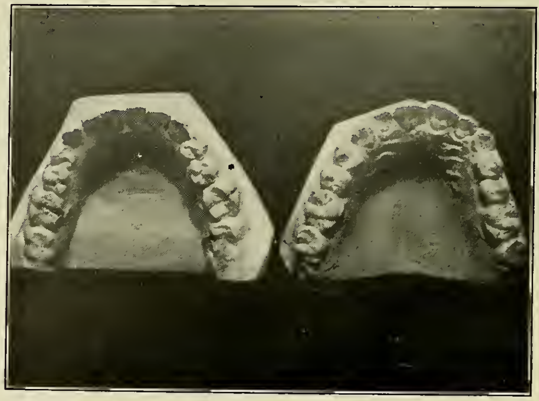

FIG. 4.

means to move the mandible and arch forward. After full eruption we may by intermaxillary force move the lower arch forward, thus "jumping the occlusion," but the mandible because of deficient development is not apt to retain a normal forward pose. Between these ages we may achieve compromise results; to some extent jumping the bite, and to some extent jumping the occlusion.

I will now show cases exhibiting the two extremes:

In Fig. 1 I show you the profile casts of Miss D., aged fifteen. This is one of the most extreme cases that I have seen, but it is only by such a case that we may fully comprehend the possible results of delayed treatment. I ask you to note the extent of the apparent protrusion; the upper six anterior teeth are all in advance of the lower.

The history of this case is unfortunately obscure. Nothing could be learned of the deciduous teeth. Yet I can not but believe that the same conditions existed with the temporary, as we observe in the permanent set, though to a less degree. There had been an operation for the removal of adenoids, which, however, in the opinion of the mother, "was not necessary." Neither would the mother admit any mouth breathing, never "having noticed it." Such a history, of course, is of no value. In Fig. 2 we see the occlusal views.

An examination of the upper cast shows a surprisingly slight departure from a normal arch. It is a little narrow, and the central incisors are a little prominent. In the lower, however, we see all the trouble. The four incisors are all lingual of normal and this, with the distal occlusion, accounts for the greater part of the seeming protrusion. Treatment therefore demanded the labial movement of the lower incisors, and the mesial movement of the lower arch and mandible if possible. At the same time it would be necessary to widen the upper arch to normal, and then to reduce the prominence of the central incisors. It may surprise some of our experts to hear me admit that I have worked over two years on this case with a result far from ideal. Fig. 3 shows a profile view of the casts of the present conditions, and Fig. 4 the occlusal view. You will observe that I am still far from normal occlusion. It would tire you to go into the details of all the difficulties that I have met in the management of this case, but it is an opportune moment to touch on one phase which is an additional argument for early intervention. After the fifteenth or sixteenth year the girl child is growing to be a young woman, with the natural desire to join in the social pleasures of her companions, and old enough to object to the disfigurement of her mouth with orthodontic apparatus. She is also old enough to think herself entitled to have some say in the extent of work which she desires. For example, this young lady would never permit me to make any effort toward the torsion of the left upper cuspid. She likewise bitterly opposed tension on certain teeth which seemed unusually resistant and unusually sensitive to ligatures of any kind.

But the great trouble lay in the fact that the subject had a dense bony structure, and a powerful muscular development.

The best that I could aim for was a compromise result; a partial forward movement of the lower arch, and a partial forward movement of the mandible. (Slides showing face before and after treatment exhibited, but the pictures can not be published.)

Supposing that the occlusion can be improved, the question arises, can this profile be maintained? I doubt it. The photograph was taken with a retaining device in place which compels the forward pose of the mandible. What the future has in store for this young lady remains to be seen,* but it is a striking example of the difficulty of obtaining ideal results late in life. Of course there is another logical deduction. Perhaps the operator has been not sufficiently skilful. Perhaps some more skilled orthodontist might have secured a better result in two years. Be that as it may, the argument holds, for the next two cases were done simultaneously, by the same man.

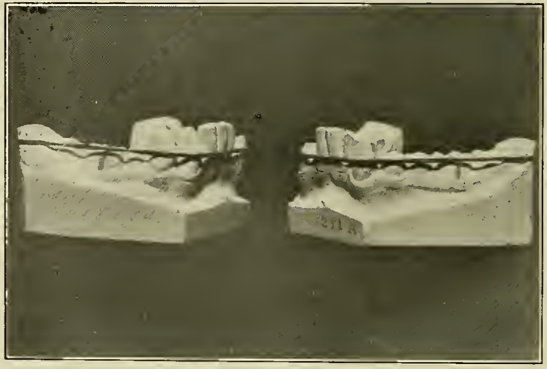

FIG. 5.

The Occlusal Plane in Class II.

Before passing this first case, however, I wish to touch on just one other point. I had originally intended to take up the subject of the occlusal plane in relation to Class II cases, but this paper is already too long, and I must let that pass for the present with just a word. A number of good orthodontists claim that in many Class II cases the lower incisors have erupted abnormally high, and that they must and can be depressed in their sockets. It has been claimed that a plate in the vault will serve this purpose, the patient biting his lower incisors down into their sockets. Others use mechanical forces applied to the teeth to depress them. I can not believe that this is either possible or needful. I do not deny that teeth may be forcibly driven into their sockets, for I have done it, unintentionally. But with the removal of force the tooth or teeth will invariably return to normal height. I can not go more deeply into that at this time, but I show you Fig. 5, the lower arch of this same case prior to treatment. Please note the black line which marks the occlusal plane of the bicuspids and molars, and then observe that the incisor crowns are entirely above that line. Could they be depressed in their sockets to assume a normal relation with the other teeth as here pictured? I think not. It is this fact which accounts for the length of the time of treatment of this case. There have been periods of rest occupying months, holding the incisors in more or less true relations, and awaiting the future eruption of the posterior teeth, for according to my belief in these cases the fault lies in the molar and bicuspid regions which have never achieved full vertical development.

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* At the present time, a year since the above was written, the occlusion is much improved, retainers being still in place. R. O.

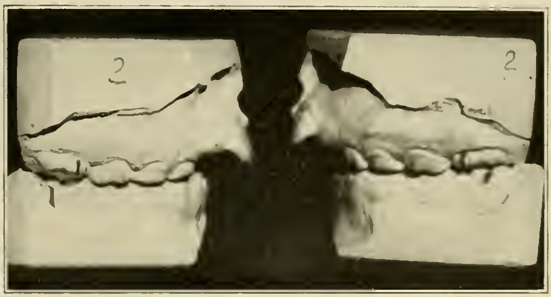


Fig. 6.

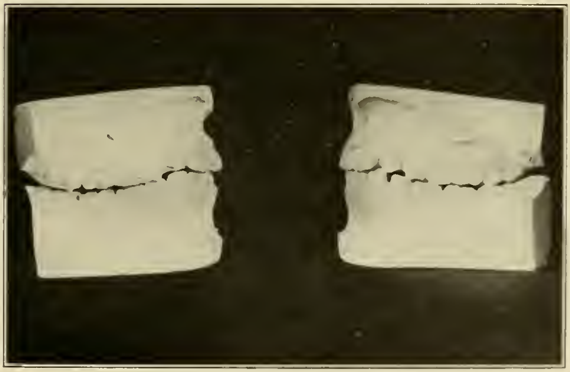


Fig. 7.

Next I show you the profile casts of a most interesting case (Fig. 6). A child, ten years of age, with such tardy eruption that we find the upper laterals still wanting. Dr. Angle has spoken of the fact that often during the eruption of the permanent teeth the deciduous set are so worn off that they exert no influence against the mal-locking of the erupting first molars. In the case before you the temporary set have been retained so long that they are proportionately as much abraded as the teeth of a man of sixty. To such an extent is this true that the overbite is seen to be so great that the upper teeth almost entirely hide the lower. This is especially true of the cuspids, the labial surfaces of the lower cuspids being almost denuded of enamel. The deciduous set are already in distal occlusion. What must be the inevitable result of such conditions? With the lower deciduous molars in distal occlusion, the first molars are compelled to erupt in distal occlusion. The abrasion of the deciduous teeth

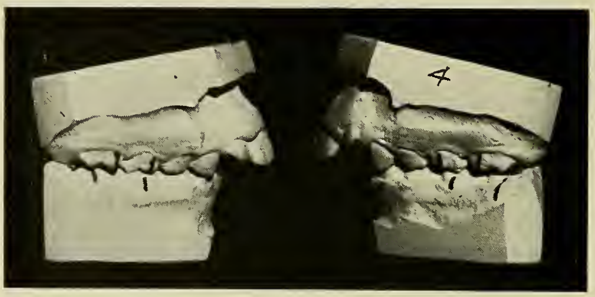


Fig. 8.

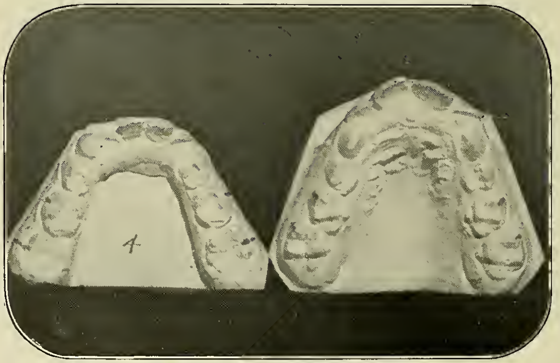


Fig. 9.

having allowed the abnormal closure of the bite, the molars, and later the bicuspids, are hindered from erupting to normal height. There is nothing to prevent the growth of the upper arch in the incisive region, producing apparently a protrusion, and there is nothing to prevent the full eruption of the lower incisors, which then appear to be too long, whereas they are really normal, while the posterior teeth are too short, from lack of vertical development. The arrested development of the upper arch compels a similar insufficient development of the mandible. Observe that I say "arch" in connection with the upper, and "mandible" for the lower. I believe there may be a lateral growth of the maxillæ which fails to carry the processes with it, so that the arch remains narrow across the deciduous molar region. Yet later the bicuspids may erupt slightly outside the arch, thus rendering the lack of development less noticeable than is the deficiency in the mandible. But so long as this narrow temporary arch remains it acts mechanically to hinder the growth of the mandible and restrains it in the distal relation. It is most note-

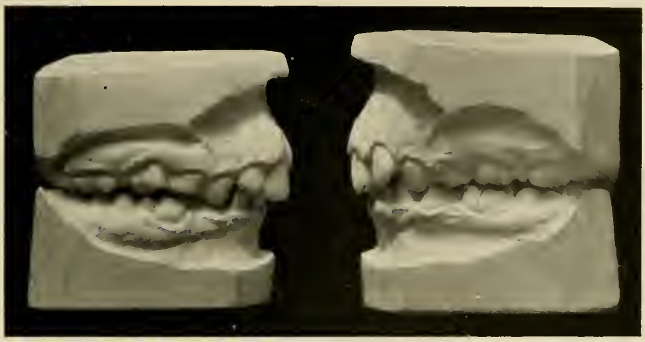


Fig. 10.

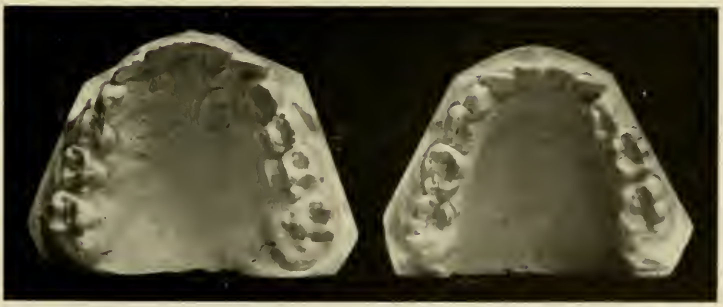
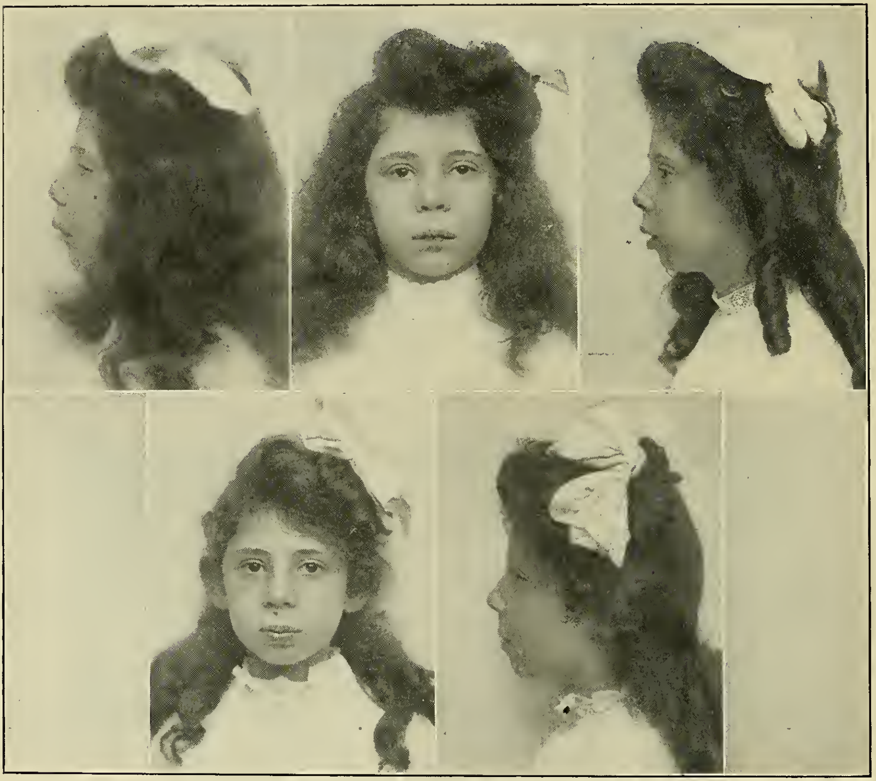


Fig. 11.

worthy that the temporary cuspids exert a tremendous influence in the case before you. If the casts of the original condition are taken in the hands, it will be seen that they can not be moved mesially into normal occlusion, because the upper cuspids will not permit the lower arch to rest within their embrace. The significance of this is that it suggests a simple procedure which may often prove of great advantage. If a child present with deciduous teeth still in place, with distal occlusion, and for any reason treatment must be deferred, an examination should be made to determine whether or not the upper cuspids lock the lower arch into distal occlusion. In such an event the judicious use of a corundum stone on the cuspids and perhaps also the molars may prove of great help, or better still, a simple device for widening the upper cuspid region could be used.



FIGS. 12, 13, 14, 15 and 16.

Fig. 7 shows the same case after only nine weeks' treatment. (Faces cannot be published.)

This child was a mouth breather and had adenoids, though at first the parent declared that a rhinologist had said they were not enough to render removal needed. Yet at a crisis in my work they suddenly determined to have the operation.

This case is in great contrast to the last, and I think emphasizes the advantage of releasing the mandible from its imprisonment as early as possible. But the next case is even more interesting.

Fig. 8 shows the profile casts of a child six and a half years old. There is distal occlusion of both temporary and permanent molars. Was there ever a more typical example of the evil results of adenoids and of mouth breathing? Yet the history of this case is most reliable. She is the daughter of a prominent and capable physician. She had never suffered from nasal obstruction of any kind. She has slight evidence of adenoids, but has never been a mouth breather, nor does she even snore. There is not a shadow of doubt in my mind but that this case, if left untreated, would develop to as great a deformity as the first case shown. The following illustrations show the progress made in this case in thirteen weeks. Fig. 9 shows the occlusal view before treatment. Fig. 10, profile casts after three months of treatment. Fig. 11, occlusal view. Figs. 12 and 13, profile and full face before treatment. As the photographer allowed the hair to hide the chin, a second photograph was made three weeks later, Fig. 14, by which we see that the mandible is already moving forward. Figs. 15 and 16 show the face at the end of three months' treatment.

What are we to think in the presence of such evidence as this? If such a condition can arise without nasal obstruction, can it be true that nasal obstruction is the *sole* cause of Class II conditions? I can not refrain from giving you the views of the father of this child. He says that adenoids mainly abound in localities of congested population: in large cities where towering walls and city dirt and dust makes the air foul and filled with foreign particles. He thinks it is not strange that eighty per cent. of children having irregular teeth should suffer from adenoids, because he declares that eighty per cent. of all city children have adenoids. He likewise points out that operative interference is not necessary unless the growths are sufficient to produce nasal obstruction, or hindrance to free breathing, and that unless this occurs, there can be little relation between adenoids and irregularity.

On the other hand he calls attention to the modern methods of feeding. Foods are soft and getting softer year by year. Breakfast foods are prepared for us so that the eater has little to do except to swallow. Can full development of a jaw be expected with such lack of use?

Gentlemen, I leave these thoughts with you for study.

Dr. N. S. Hoff. This paper opens up a good many things that seem to me to need discussing, but many of them are of a technical character and I do not care to undertake the discussion of those points. I can not add much to the value of the paper, and have very little to find fault with, probably for the reason that I do not fully interpret the paper. I did not arrive in time to hear its reading. There are one or two points I will speak of, however, although I may have nothing new to say about them.

The essayist says he has seen upper protruding teeth, but never an upper protruding jaw. I can not so interpret the pictures he shows on the screen, for some of the illustrations I believe not only show upper protruding teeth, but protruding jaws as well. It seems reasonable to suppose we should have hypertrophy or overdevelopment of the upper jaw, rather than of the lower jaw.

If any of you will recall the work of Cryer in sectioning the skull, you will remember the great differences he discovered as to the formation of the air spaces—how much larger they were in some cases than in others, and yet how regularly the jaws were developed. I recall Dr. Hartz's presentation also as to the development of the jaws, symmetrically and concordantly, under the same nerve influence and impulses. I can not understand how one jaw can be overdeveloped and the other underdeveloped. How could nature fail of the same kind and extent of development when controlled by the same nerve influence, and when developed in the embryo in the same manner and at the same time? I can only account for it by some mere accidental causes. To undertake to establish a principle that one is overdeveloped and the other underdeveloped, it seems to me would be going a little too far. The underlying principle in development is harmonious.

The essayist says it is because of malnutrition that the mandible is insufficiently developed. As I have looked at all the pictures shown here during the past two days, it has seemed to me in every one of them, almost, I could see exaggerated development, if anything, in the nasal and facial region rather than a lack of development in the mandibular portion of the face.

We have types of individuals, or people, as well as animals. The bull dog has a strongly developed mandible and meagerly developed maxilla. When there is a variation from that in the bull dog, we know it is abnormal and he is a mongrel. We do not expect that in human beings of pure race or type that this law should be different. The jaws and face ought to be symmetrical. When they vary from that it is accidental and does not come from any particular line of causes, so that you can not make a principle of it, embryologically or physiologically, to say nothing of building on that a principle of practice for the regulation of such malconditions.

I believe the location of the teeth in the jaws is, in every case, purely accidental when they are abnormally placed, and can not be attributed to a lack of nutrition.

You orthodontists seem to have adenoids on the brain and believe they are responsible for everything abnormal! Adenoids may cause this hypertrophied condition of the upper jaw, but other things could do the same, such as irritating influences of the nasal membranes during the period of development, diseases irritating the air passages alone or nervous diseases which influence the respiratory muscles of the nose, larynx, trachea, chest, etc. These accessory muscles, because of nervous disorders or affections, have much to do with the symmetrical development of the face.

Irritations occurring in the air sinuses of the face must have as much influence as stenosis from adenoid growths, or anything we may have of that kind. It is almost impossible for us to say any particular form of malocclusion is caused by adenoids, or any other particular disease. It may be a combination of any or all of many disorders.

I believe much more strongly than some of my associates in the contention of Dr. Angle as to the position of the upper first molar being more constant than that of any other tooth. I believe that he is right, and logically it ought to be so. Sometimes it is not so, but this is accidental and not a natural result. I should feel more thoroughly convinced, however, if he should make it the first molars of the lower jaw, for the reason that the mandible ought to be developed more normally than the maxilla. It is subjected to less accidental interference in development than the upper. There is absolutely nothing to interfere with the development of the lower jaw, unless it be unusual accident. There are no air sinuses here, which are liable to become infected and diseased during early life. The jaw simply develops in the muscular fascia and the muscles surrounding it which hold it in shape. The buccal muscles, muscles of the neck and the tongue, hold it in proper form. It has a free and liberal supply of blood. The nerve supply is as good as that of the upper jaw, so why should it not develop into normal size and form? There is no reason except it be an accidental reason, and there are not anything like so many chances of its being badly developed as in the case of the upper jaw, where there are so many changeable conditions, because the bones are so thin and frail that they may be so easily disturbed.

The growth of bone is interstitial. The mandible develops from six centers, and is one of the first bones formed, and it should usually be normally developed. If I were to make a suggestion it would be that we take the lower first molar as our standard; when the jaws are in normal relation we can then develop the rest of the face in accordance with that.

The question of nutrition can have little to do with unequal development, as the nutrition would be similar in both cases, and it is concordant. Why should the upper jaw develop excessively at one period and the lower at another?

I can not see then why we should speak of the mandible as being insufficiently developed. Sometimes we see people without chins, and we think of them as lacking in character and mentality. Some of us have to grow whiskers on our chins to make a presentable appearance! The mandible and the chin should develop in uniform relation to each other, and when they do not it is because of some purely accidental cause, and the cause can not always be attributed to malnutrition.

The upper jaw is as often at fault, in my judgment, as the lower, and instead of trying to develop the chin we might, with equal propriety, try to reduce the hypertrophied growth we have in the upper jaw—reduce the nose and face and bring things into harmony.

The pictures Dr. Ottolengui has shown us, in most cases indicate that the middle part of the face is usually not longer than normal, but there is always a fulness and prominence that do not belong there. It is not natural or harmonious.

We may think Dr. Angle is wrong in his statement as to the position of the upper first molar tooth, but if you will make it the lower first molar, that is in normal relation to the jaw, I believe you will have discovered a valuable truth.

Dr. Milton T. Watson. The essayist describes the dogmatic manner some men have in dealing with patients afflicted with malocclusion. It certainly indicates a very meager comprehension of the subject for a man to declare adenoids to be the sole cause of malocclusion. It seems incredible that any man could ascribe the malocclusion to any one cause, for it is so apparent that there is a great combination of factors involved. It is quite true that we have not as yet been able to determine absolutely the relative importance of each of these factors, and it is equally true that many men believe nasal occlusion occupies a very important position, with which I heartily agree. The very fact that complete nasal occlusion not only interferes with the function of the nose, and thus in turn with the development of the maxillary sinus and its surrounding bony tissues; but that this disturbed function also compels disuse of the jaws and teeth, which in itself is a vital consideration, compels us to give heed to this condition. It must also play a part in malnutrition—another factor of some importance. I quite agree with the sentiment that too much importance has been laid upon the stress of the cheek muscles; it is, however, a perverted function, and if associated with a *short upper lip* is of some importance.

It would, in my judgment, be quite as unwise to utterly ignore the nasal involvement as it is to go to the other extreme and hold that it is the one and only factor demanding consideration.

Discussing the etiology of distal occlusion further, the essayist shows the inconsistency of Dr. Angle's deductions, and rather intimates that because his book is the most recent addition to the literature of orthodontia, that the ideas therein contained express the generally accepted thoughts of the day. I believe this is quite true so far as the means and methods of achieving tooth movement and permanency of results are concerned, but the enormous energy and time the man has expended in this direction has, I believe, left him little time for investigating the etiological factors, in which he has been too hasty in his conclusions. He has done so much, however, for which we are indebted to him, that we should consider his errors with a generous amount of charity, though I do not mean you to infer that I think they should not receive adverse comment.

I am in perfect accord with the idea that deficient development of the mandible in Class II cases, particularly Division I, is the most troublesome and about the most conspicuous factor with which we have to contend directly; and that deficient development of the maxilla becomes an equally prominent factor in Class III cases. This, of course, is in direct opposition to the idea recently advanced that the upper first molar is practically always in its correct mesio-distal position. I am already on record as being utterly unable to believe that the position of this tooth is anything like as constant as some writers claim it to be, and further observation continues to strengthen this belief. The fixing of the time at which distal occlusion begins as being simultaneous with the eruption of the first molars is, of course, so utterly unscientific as to scarcely be worthy of notice, except for the prominence of the man suggesting the idea—the fact that complete distal occlusion in the temporary teeth has been seen by numerous operators being conclusive proof to the contrary.

I think it well for us to consider carefully each case by itself, in our efforts to find just where the fault lies in any case of malocclusion, rather than to accept a dogma which compels us to believe that in all Class II, Division I cases the trouble is solely an underdevelopment of the mandible, and that in Class III cases it is solely a deficiency in the maxilla. I believe that these conditions are usually present to a greater or less degree, and I am equally confident that I have seen upper molars that really needed to be moved distally, and some cases of an undue prominence of the mandible itself. I recognize the fact, however, that an unfortunate angle in the mandible may mislead one in making a hasty examination.

(Further discussion was postponed, and Dr. Baker was called to read his paper.)

Some Observations on the Temporo-Maxillary Articulation in Changing the Occlusion.

By Dr. Henry A. Baker, Boston, Mass.

When your committee wrote me, inviting me to prepare a paper for this meeting and choose the above subject, I suppose they fully realized that there is no one who knows what actually takes place in the temporo-maxillary articulation in changing the occlusion.

Therefore, if you expect me to tell you positively, I am afraid I shall have to disappoint you. Neither will I, on the other hand, tire you with a long-drawn-out paper, theorizing. But I shall, however, endeavor to make plain to you the great changes which can be accomplished in the way of moving the mandible. You are doubtless acquainted with the many views held on this subject and possibly have decided opinions of your own, some of which, I trust, will coincide with mine. Some authorities claim that there is no movement of the mandible, but the movement that takes place is confined to the teeth, while others assert that the condyle forces back the soft tissues of the glenoid cavity.

In my opinion, in nearly, if not in all, of the pronounced cases, mark you pronounced cases, of prognathism, of Class III, the mandible is not where nature placed it. In other words, a change in position has taken place. Through habit, a forward movement is brought about similar to that which we create in changing a case of distal occlusion, or

Class II. If the above is not true, it would seem impossible to force as marked a change as we are able to accomplish in these cases. I shall show you by the lantern slides a case where the lower jaw was carried back at least three-eighths of an inch.

Cases from Practice.

Fig. 1 illustrates a marked case of Class III, in a young woman about thirty years of age. My opinion is that protrusion was greatly increased by the extraction of the lower molars. The replacement of the mandible was accomplished in a satisfactory manner after six months' treatment. In order to have accurate data regarding the actual movement of the mandible, the indicator appliance illustrated in Fig. 3 was constructed. This appliance consists of a metal band spanning the forehead to which was attached a narrow nose piece of the same material, which carried two rigid wires bent in such a way that one rested upon the labial surface of the lower central incisor near the cutting edge, while the other touched upon the chin directly in front of the mental process. To make the adjustment accurate, soft modeling compound was placed under it and allowed to harden after the appliance was brought to its correct position, and firmly strapped in place, thus assuring an accurate replacement. Upon completion of the treatment the indicator was again applied and to my utter satisfaction proved the actual movement of the mandible. The reader will readily observe the marked distal movement of the mandible at the chin; but I wish to call particular attention to the movements accomplished in the incisal region.

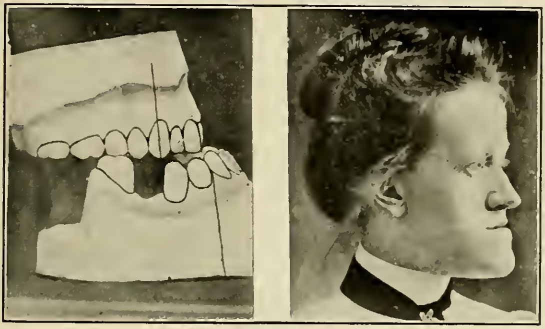


FIG. 1.

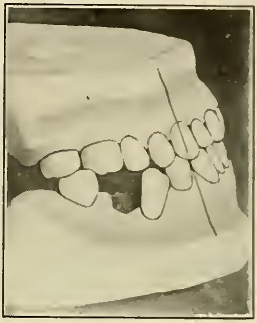


FIG. 2.

In order that you may fully comprehend these movements, I call your attention to Fig. 2 and ask you to compare the relative inclination of the incisors in this figure to that of Fig. 1. It will be readily seen that in Fig. 2 the incisors are in a more erect position than before treatment, and yet reference to Fig. 3 shows that they are distal to their former positions by at least one-eighth of an inch. Thus we are satisfied that while the mandible was forced distally three-eighths of an inch, the incisors were erected one-eighth of an inch.

It would seem to me that if the condyle was in its normal position, by carrying it back three-eighths of an inch it would bring great pressure on the walls of the auditory canal and affect the nerves of the internal ear and possibly the hearing.

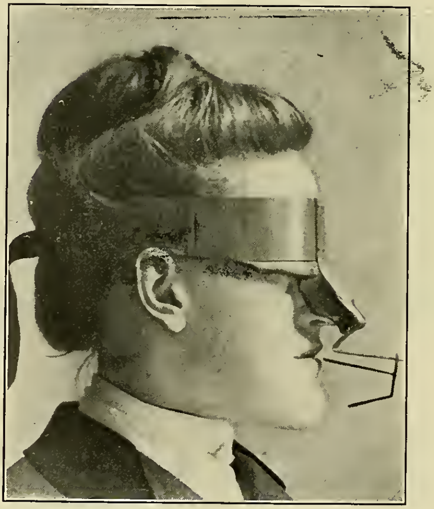


Fig. 3.

If I remember correctly, I mentioned this habit theory to this society in New York. Mark you, gentlemen, habit is a very strong factor and I may say that the further I look into this subject the more firmly convinced am I of its truth, and I hope to prove it to your satisfaction by my lantern slides.

Fig. 4 is introduced to show what habit will sometimes accomplish. The habit was doubtless caused by the extraction of the lower molars. Reference need only be made to Fig. 5, which shows the young man some years earlier in life to illustrate the unhappy facial results. These habits often occur in very young children where no extraction has occurred.

Fig. 6 shows a case of this kind where the child evidently had two well defined bites. These two cases are simply representative of their kind and many such have come under my observation.

There are conditions in connection with this subject which seem hard to account for. For instance, in carrying the mandible forward in cases of distal occlusion, or Class II, we have all probably had considerable experience, and no doubt many of you have noticed that by holding it in its forward position a considerable length of time that it is impossible for the patient to bring it back to its original occlusion, and on some occasions when released the mandible will take its forward position unaided.

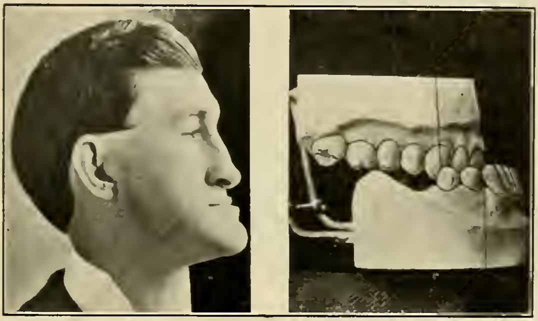


Fig. 4.

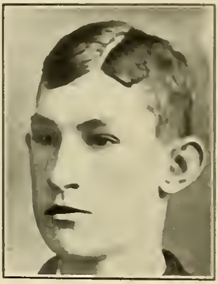


Fig. 5.

Now it would seem that after advancing a claim of this nature we should be careful to make this distinction, that we are speaking of those cases where, through habit or other causes, the temporo-maxillary articulation has been interfered with and the condyle has assumed a position anterior to that intended by nature; here we must of necessity produce a movement sufficient to place the condyle again in its natural position. In such cases, we may be reasonably sure that the movement has taken place after the application of adequate pressure; but on the other hand, in the treatment of those cases of Class III where there is no evidence of change in the temporo-maxillary articulation, but which are due more to the lack of development of the maxillary bones or the over-development of the body of the mandible, it would be unreasonable, or even impossible, to effect a change without seriously interfering with the auditory canal. It is, therefore, essential that this difference between these classes must be clearly defined, and in making our claim that the change takes place in the temporo-maxillary articulation, we must make it plain that we mean those cases where an anterior movement has already taken place. It will be noted that a large percentage of these cases are due to the extraction of quite a number of teeth, especially the lower molars, and a reaching habit of the mandible takes place in the effort to acquire more adequate occlusion.

There may be serious doubt in some minds, even in these cases, that a forward movement takes place, or that it may be replaced; but in support of this claim I wish to introduce a quotation.

Some years ago, when I was correcting my first case of prognathism, and I would say it was about this time I discovered the habit theory, my son, Dr. Lawrence Baker, became very much interested and speculated quite a good deal as to what did take place. Soon after this case he had occasion to visit Dr. Cryer and he speaks of it as follows: "A most interesting morning spent with Dr. Cryer in his museum. He was decided in his opinion that there was a migration of both joints. . . . In some specimens, the old articulation was completely obliterated. In others, the path of the condyle could be definitely traced."

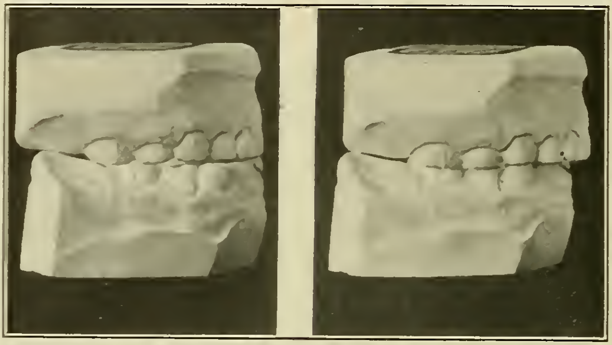


Fig. 6.

Reasonable doubt is thus set aside and we are confident that in applying pressure to the mandible in such cases, we cause a reabsorption of the tissues which nature has deposited behind the misplaced condyle.

Discussion.

Dr. Norman G. Reoch. I must first compliment Dr. Baker upon his excellent paper, although we all wish, I am sure, that he had written a longer one.

He begins with the statement that we will perhaps be disappointed in his not giving us a positive answer as to just what takes place in the distal movement of the mandible. His slides, however, in the first few pictures thrown upon the screen, and the apparatus employed to make measurements, prove pretty conclusively that there was a distal movement of the mandible—and a considerable one—in this particular case. Just how this movement occurred is still a matter of conjecture. I believe, with Dr. Baker, that in certain cases there is a displacement of the mandible, or a slight dislocation of the joint: that from long-continued use of the jaws in their abnormal relation there is a filling in of the joint just posterior to the condyle with thickened ligaments.

This theory that Dr. Baker has brought out explains very well why it is that we get such rapid adjustment of the parts in certain pronounced cases of Class III. If you will remember, Dr. Dunn presented a paper on this subject at our Chicago meeting. When the intermaxillary force was applied there was a rapid distal movement of the mandible: that can only be explained by admitting that it returned to its normal articulation.

In this kind of a case there is not so much movement in the teeth as in the mandible. In other cases of Class III, however, the joint may be perfectly normal. When this is true, the movement is confined to the teeth alone, in my opinion. Most of the change in the profile is accomplished by the mesial movement of the upper teeth. It is rather difficult to determine just where the movement does take place.

Dr. Baker has shown very nicely the part habit may play in commencing some forms of malocclusion that might afterward develop into permanent types.

Dr. Casto. I have enjoyed the papers of Dr. Baker and Dr. Ottolengui very much. Dr. Ottolengui said to me in New York last December that he would present the best paper at this meeting he had ever presented before the American Society. In a subsequent letter he reiterated that statement. He has done so. We might well request Dr. Ottolengui to continue his investigations along the same line and report them to the society.

Dr. Ottolengui's position regarding the cases of malocclusion coming under Class II, Division I (Angle classification), substantiates, in this particular class, Dr. Angle's claim relative to the constancy of the upper first molars. Dr. Ottolengui believes the mandible is always at fault in such cases, and says that he has never seen the protrusion or mesial position of the upper jaw.

Regarding what Dr. Ottolengui has to say about the normal size of the mandible in Class III cases of malocclusion (Angle classification) I think further investigation will have to be made before we can accept his conclusions as final. There is no doubt in my mind that some change in the temporo-maxillary articulation does occur in some cases of Class III. If some skulls could be found where Class III cases of malocclusion of the teeth had existed, the mandible could be placed in its normal position in the Glenoid fossæ, which would probably enable us to determine whether or not the mandible was in its proper developmental relation to the other bones of the head and face.

In many cases of Class III there is no question but that the mandible is protruded in its relation to the balance of the face. Whether in such cases it is an over-development of the mandible, or whether the mandible has become fixed in a forward position in the temporo-maxillary articulation, is a question yet to be settled.

Dr. Ottolengui spoke of Dr. Angle's views regarding the classification and treatment of Class II cases. It is my understanding that the classification as given by Dr. Angle is applicable to the models only, and is applied irrespective of treatment. That is to say, the classification of a given case is to be made strictly in accordance with the occlusion of the teeth as observed by the use of the models, and has no relation to a stereotyped form of treatment for the correction of facial defects or for the establishment of harmony between the dental arches and facial lines. The treatment is to be determined subsequent to the classification.

On one occasion I talked to Dr. Angle regarding the forward movement of the upper molars and bicuspids, where the temporary cuspids had been prematurely lost. He classified such cases, from the models alone, as Class II cases. He said that in the treatment it would have to be determined whether the upper molars and bicuspids should be moved distally or whether the mandible should be moved mesially, by the requirements necessary to establish the best facial harmony. That has always been my understanding, and that is the method I have always followed.

Dr. M. C. Watson. I wish to say one word regarding the change that may take place in the temporo-maxillary articulation. I have a case of a young child where I used the chin cap exclusively in a case of Class III; an interesting feature being that after some weeks of treatment, during which time considerable change had taken place, the child jumped out of bed one night and ran to her mother, saying: "O mother, my jaw just went back"—and it had gone back suddenly.

Dr. Varney Barnes. It has been a source of satisfaction to me to listen to the remarks of Drs. Ottolengui and Watson. Were it not for the easy-flowing language, I might have thought my own ideas of the past two years were being expressed. I have published many of those ideas, and think they have been misunderstood. I believe emphatically that malnutrition is a big factor. We do have many causes contributing, but I believe the malnutrition may be both post-natal and pre-natal. If post-natal it is different from pre-natal. If pre-natal the indications that may later on show themselves in malocclusions will be shown at birth in the child. Proceeding on this theory I have sought the opportunity of seeing children very shortly after birth, before they begin to flesh up. A child fat at birth is abnormal; bone development is not there, but soft tissue development is there.

If the malnutrition is pre-natal, may it not, instead of acting alike on the maxilla and the mandible, produce a different effect on account of the difference in time of development of the two jaws? That is possible; hence there may arise a lack of development of the mandible. I put this before you because I want you to investigate it as I have done. There are five or six cases that I have examined in this way. I diagnosed three of them at birth, and my diagnosis has been corroborated, and I hope later to show them before this society. I have the records.

Suppose the malnutrition is post-natal. Then you may have it aggravated by non-use, habits, growths of adenoids and such things. I am on record over a year ago in saying I did not believe adenoids were responsible for as much as they have been credited with. I believe they are harmful in that they cause the perverted use of certain organs we should use normally. This may come from climatic conditions, or from too small air passages. In distal occlusion cases sometimes there are no real adenoid conditions. I have watched this matter in conjunction with rhinologists. They came to the same conclusion I have.

The remarks of Dr. Baker regarding the throwing forward of the mandible seem to be well taken. My own little girl has an apparent underdevelopment of both upper and lower jaws. She has the peculiar habit, when you say anything to her which she does not quite believe, of throwing the lower jaw forward with a peculiar expression. In that connection I believe we have the solution of those cases in this way, that the maxilla is underdeveloped; the temporo-maxillary articulation is too narrow, and, as corroborating Dr. Hoff's suspicion that the lower jaw has a better chance of development than the upper, I will say that I believe it.

I wish to report the case of a child nine years old. There is a deformity of the head affecting the external ear, producing deficient hearing; maxilla is undeveloped, as are also the rami and body of the mandible. She is the daughter of a physician, with history of pre-natal accident to the mother. The child is very bright, with well developed figure. I used apparatus of the Ainsworth type. I expanded the maxilla, thinking I might get luxation of the lower jaw. I ordered the child to chew gum. In expanding the maxilla the suture was opened until the central incisors were separated a quarter inch. After five months' treatment she can bring the lower jaw forward one-fourth of an inch. Hearing is improved markedly. She can hear the rustling of the leaves of the trees, a thing impossible before she came under my care. I leave this with you for thought.

Dr. Bert Abell. I have in my possession models of a four-year-old which illustrate Dr. Baker's views on habit. She is the daughter of a dentist in Toledo. She had the habit of continually biting in one direction, and he brought her to me for treatment. I expanded the lower arch, because you will see the lower on the right side is in lingual occlusion to the upper. It is interesting as an example of biting over and getting the teeth into a condition of malocclusion through habit. (Models exhibited.)

Dr. Hawley. I think Dr. Baker has presented here one of the very important problems that remain for someone to decide positively. While we have much evidence of belief, and of cases where things seem to be, we have very little or no absolute proof as to what takes place in the temporo-maxillary articulation. Positive knowledge of what is possible will have a great bearing on treatment and on retention.

In treating young patients, and in the critical examination of the arches, I have noticed how marked it is that the upper jaw is always and universally narrow. The lower jaw, in my observation, is far more universally well developed. In treating those cases from six to seven years of age, it has rather been the exception when any intermaxillary force is needed. The simple widening of the upper jaw and harmonizing of the two arches is often all that is necessary.

I have two cases in mind, of the developing third class, where I thought I would have to use intermaxillary force; but the harmonizing of the arches was all that was necessary. The same has been true with many developing Class II cases. It has been rather rare, unless the case were thoroughly established and more than ten years of age, where the jaws would not naturally find their normal position without any intermaxillary force.

I think that what Dr. Hoff has said is true as to the normal development of the mandible. The malnutrition is shown more in the upper jaw. and the influence of pathological conditions of the nasal passages are acting on the upper jaw rather than the lower. When the upper fails to develop. the lower jaw seeks its most comfortable occlusion, which is generally distal and not so often mesial; because in a narrowed upper jaw, with the lower normal, it must seek distal occlusion to become comfortable. The fact that this is true, and that we have cases cited by Drs. Watson, Dunn and others where the course of treatment seems to indicate that the mandible was in an abnormal forward position and suddenly went back, causes me to believe there is a change produced irrespective of the position of the teeth. There is an opportunity here for some thorough, scientific work, to determine the actual changes. That which takes place in the other joints of the body is in harmony with this hypothesis. The hip joint can be changed, as in congenital dislocation of the hip. The natural socket is filled with a new tissue. The reformation of the joint is required to be done by the orthopedic surgeon.

Dr. Kemple. I will only say I am very glad I came. There have been papers presented before the society at this meeting any one of which would more than compensate a man for the time spent in making the trip to Detroit.

Dr. Ottolengui. We are all appreciative of everything Dr. Angle has done, but it does not seem to me we are obliged to follow him into error, if we think he is in error. The academic fact that the upper first molar is normal in its mesiodistal relation with the skull in ninety per cent. of all cases is not the point that Dr. Angle has attempted to make. We are ready to admit that. But when you take from the whole number of people those suffering with malocclusion, that is another question. The percentages would be quite different where the teeth are in normal occlusion or in malocclusion.

Let us admit for a moment that the upper first molar is fairly constant in its position in Class I and in Class II: that would probably establish your seventy per cent. of cases. We still have Class III, and Dr. Angle tells us it is correct there also, and there is where we can not follow him.

Dr. Baker. I do not see that there is much left for me to say. You agree with me too well. There is one point: I have given you a nucleus; I would like you to watch especially the children. The more I investigate this matter the more I believe these protruding mandibles come, in large percentage, from habit. In cases of extraction in the molar region the condition is brought about later in life, but I think in the majority of cases the habit comes on in childhood. I trust we may learn something still more definite some day.

Early Treatment in the Correction of Malocclusion of the Teeth.

By D. Willard Flint, D.D.S., Pittsburg, Pa.

Upon the importance of early treatment orthodontists all agree, and never was the old adage that "a stitch in time saves nine" more applicable. The fact is, we could all hope that our efforts might be preventive rather than corrective.

The general practitioner does not detect incipient malocclusion and there is always an indication which the trained eye of the specialist is quick to observe, therefore I believe every orthodontist is under obligations to the general practitioners to appear before them and impart some of the knowledge that he has received and the results of his experience. As Dr. Hoff has said, we ought to have "a burning message" and show the general practitioner how much deformity can be averted by doing the right thing at the right time. We ought to be on such good terms with our confreres that they would count it a pleasure to consult with us when in any case there is doubt as to the manner of procedure. How often mouths and faces are ruined for life simply because of an aching deciduous tooth, the mother asking for its removal, the dentist acquiescing and the child becoming the unknowing victim, and our cabinets of models tell many tales of arrested development, any and all of which might have been averted by proper care.

Importance of Teaching Orthodontia in College.

We are not doing our duty if we neglect the call to a chair in a dental college. We may not be able to afford the time from a pecuniary standpoint, but surely because of the great good it will do the mass of humanity we ought not to neglect such an opportunity of teaching the great principles of orthodontia.

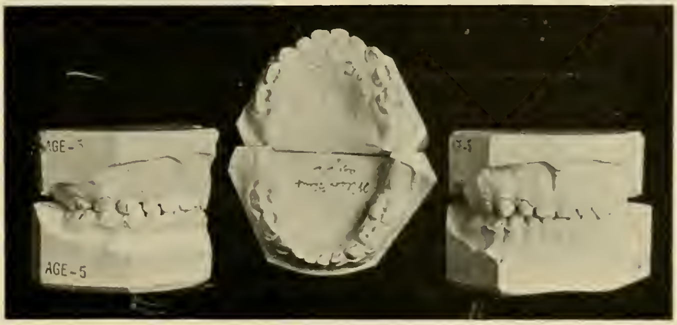


FIG. 1.
Lateral occlusal and anterior views, showing normal interproximal spaces in a child of four and a half years of age.

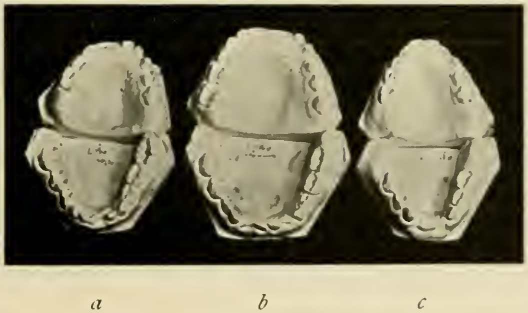


FIG. 2.
(*a*) Lack of development between deciduous cuspids in a child of seven years. (*b*) Normal development in a child of seven, showing contrast. (*c*) Lack of development due to an automobile accident, prematurely losing lower deciduous incisors.

We may have some difficulty in making the older practitioners believe all we claim, but the young men in school are there for the purpose of learning, and if we are true to our calling we surely can, by the use of hundreds of actual photographic slides, demonstrate the truths for which we stand. Let the students see and they will believe, and what better messengers of truth can we have than the army of new men graduating each year? The students *can* learn occlusion in school, and I say it emphatically; they can learn the value of a tooth, the absolute necessity of retaining all the deciduous teeth up to the time of their normal loss and replacement by the permanent teeth or the mechanical retention of the spaces of such deciduous teeth if any are lost prematurely.

In one of our schools the senior class can give twelve reasons why the first, or principal molar should be retained at any cost; they know how to diagnose, which is second only to the great truth of a knowledge of occlusion; they know when to suspect pathological conditions in the nares from the teeth and facial expression; the possibilities of beautifying a human face, and many other truths of like nature. The student can not get the practical clinical work in school, I admit. The teaching of any subject in any school never made any man proficient; it is practice only that accomplishes this. With this knowledge, are not these students infinitely better than if they were graduated without the knowledge which this chair can and does impart? If a man has a fondness and aptitude for the special work then let him take a post-graduate course, but by all means give him the chance to get knowledge of such principles of orthodontia as should be included in a dental curriculum, because he needs it at the beginning of his career.

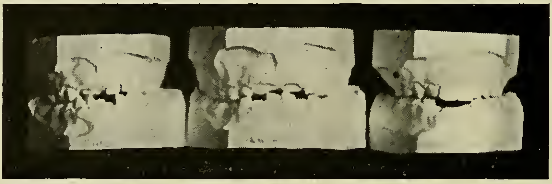


FIG. 3.

Anterior views of same three cases.

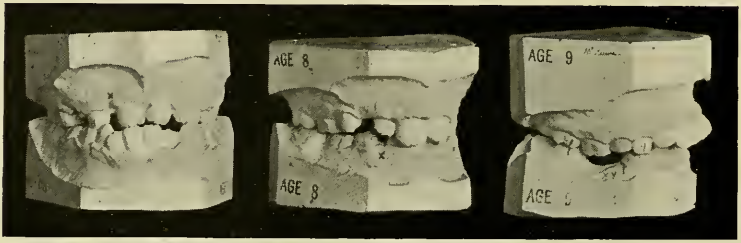


FIG. 4.

(*c*) Loss of all four premolars in lower arch; notice dropping back of lower incisors. (*b*) Loss of deciduous cuspids at eight years; notice overbite and distal movement of incisors. (*a*) Premature loss of deciduous lateral, permitting centrals to drop into lingual occlusion.

Need of Early Treatment.

To the query "Why treat patients so young?" I would reply that it is more advantageous in every way. Prevention is always better than cure. I am glad the day has come when parents will not listen to the old anthem "Wait, wait!" but rather hearken to common sense arguments in favor of early interference. When does the physician treat spinal curvature, club foot, hare lip, and other deformities of children? When the children can "appreciate it," or when "pride asserts itself"? No! the earlier the better; and in orthodontia, some cases must be taken early if we are to accomplish perfect and permanent results. From Dr. Angle we learn that the deposition of bone around the roots of the teeth is far from complete even at the ages of twelve or thirteen, and that the sockets are much larger in early childhood. Then why not, in our corrective work, assist nature rather than wait until the second dentition is completed, and then tear down and have to resort to a secondary building

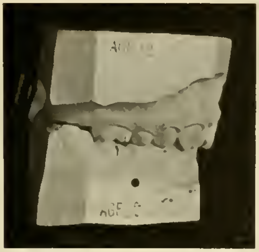


FIG. 5.
Loss through caries of mesial one-third of lower first molar.

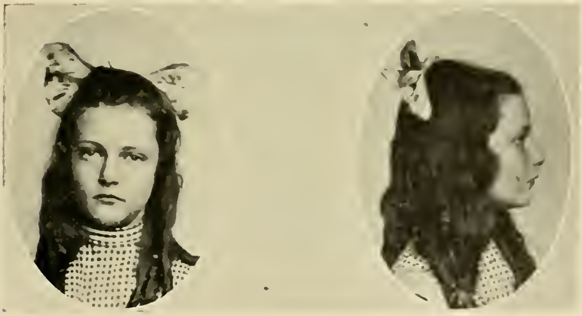


FIG. 6.
The result in facial expression of fifth illustration.

up process. In other words, let us guide the teeth as they erupt into their proper places, and the deposition of bone around the roots of the teeth will be as nature first intended.

The cancellous nature of the bone and the less number of permanent teeth offer less resistance to arch expansion and the other like operations in early childhood, than after the completion of the second dentition, allowing shorter and painless methods of treatment, and finally, and principally, stimulating nature's own developmental processes.

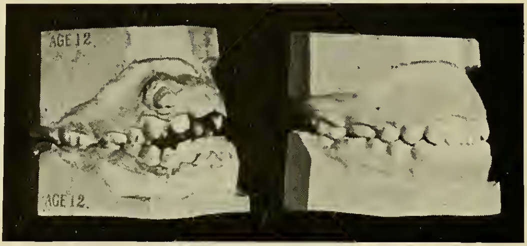


Fig. 7.
Lateral view—case of patient suffering from adenoids and enlarged tonsils.

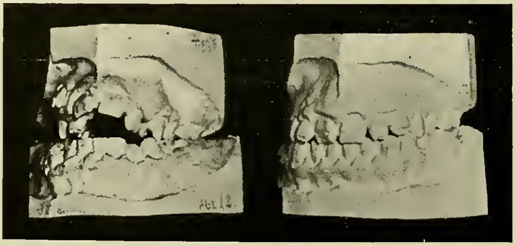


Fig. 8.
Anterior view of same case.

Tractability of Children.

With children we can do anything in the line of treatment. They never object to the conspicuousness of appliances, and their inconvenience is but trifling, while in older persons the pain is quite severe at times, even with all the precaution we can possibly take to alleviate the same, and however much we try to persuade ourselves that there is not much real pain. I have had some cases, patients over twenty years of age, where the work was to be done only on the assurance that the appliances could not be seen, and when occasion demanded, they had to be removable. You might argue that such patients do not want the work done very badly, or they would endure this inconvenience, but I disagree, and knowing what I do I would have desired the same kind of service which they received.

Objections to Early Treatment.

In extensive cases of malocclusion in the young it is quite natural to find some obstacles in the way of treatment. If the patient had to have appliances in the mouth continuously there certainly would be an objection because of the great care that must be given those mouths to avoid inviting early decay. But this work should never be continuously performed; rather what is most necessary at a given time, retaining the same, and waiting for development; then if any other interference should appear necessary as development progresses it should be attended to.

I do not believe that in all cases of malocclusion in the deciduous dentition it is necessary to interfere, but surely in all cases where there is lack of anterior development or inharmony in the dental arches, as in Class II, Division 1 (Angle classification) where there is a pathological condition operative, or in developing cases in Class III, it is necessary, in order that we may have normal interlocking of the first or principal molars. The beautiful results in Dr. Mendell's case a few years ago certainly have been an object lesson and a help to all who have seen the wonderful results in treating a patient four years of age, and just a look at the final results is proof of the necessity and the feasibility of such an undertaking. Every one present has had experience in expanding in the deciduous dentition, for lack of anterior development, but it has been only in recent years that any great amount of work has been done with malocclusion involving a change in the mesio-distal relations of the jaws, in the deciduous dentition.

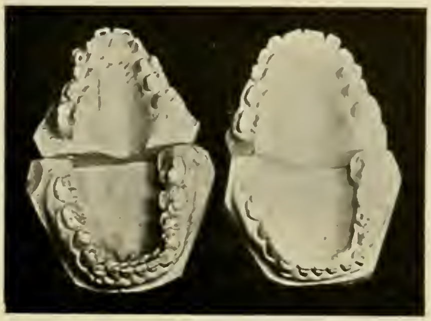


FIG. 9.
Occlusal view showing expansion.

Lack of Development.

In regard to the causes which make early treatment a necessity I would name lack of development as a principal factor. Dr. Angle tells us that something like over seventy per cent. of the cases fall into the first great class, and that in this, the malocclusion is in the anterior region in both arches. Should this not make us stop and think more seriously of the probable causes and find some means of overcoming these arrested developmental conditions?

The Indian as a race has not this trouble because of his outdoor life and the proper performance of masticatory function in the chewing of tough and fibrous foods. At the age of four there should be a commencement of the separation of the deciduous incisors, indicating that the permanent incisors are forcing their way up or down as the case may be, and if we find no such condition, nature ought to be stimulated by some mechanical means whereby the necessary room is provided. Every child at this age should be seen and passed on as to whether or not there will be room for the oncoming permanent teeth. We can not do this, but the general practitioner should have the interests of the patients so at heart that he should explain to the parents about this development, when to expect it, and to advise preventive treatment, if the conditions justify it.

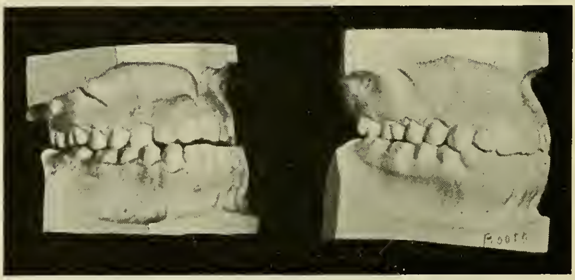


Fig. 10.
Lateral view—pathological cause, enlarged tonsils.

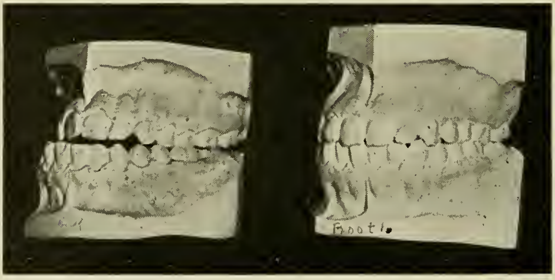


Fig. 11.
Lateral view—(same).

The exact amount of separation necessary can be determined after the presentation of some one of the permanent teeth by making use of some of the precepts which Dr. Hawley has presented to us. For lack of a better way of saying it, the deciduous incisors plus the spaces should equal that of the widths of the permanent incisors (Figs. 1, 2 and 3).

Loss of Deciduous Teeth.

If we would have the normal development of the jaws it is absolutely necessary to keep all the deciduous teeth *in situ,* up to the time of their normal loss and replacement. If we lose, let us say, the first deciduous molar, what happens? The sixth year molar exerts its wedging influence upon the second deciduous molar, pushing it forward, the natural tendency of tooth movement, lip pressure forcing the anterior teeth distally, and the space is closed. Then the first bicuspid must either erupt buccally or lingually or be delayed and classed as tardy eruption. If any molar or cuspid (deciduous) is lost prematurely the space should be maintained by mechanical means such as bands united by wire of sufficient resistance, thus giving the arch the best opportunity for future normal development (Fig. 4).

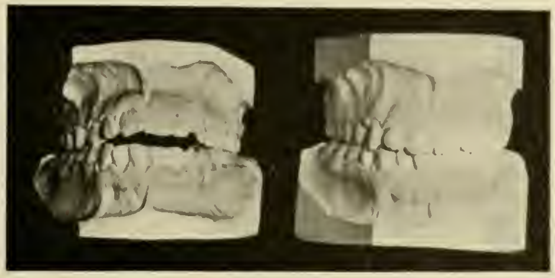


FIG. 12.
Anterior view—(same).

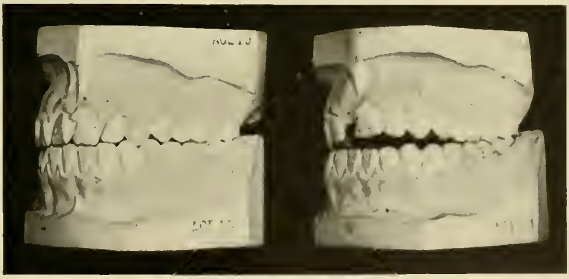


FIG. 13.

Tardy eruption of right superior central owing to prolonged retention of deciduous central.

Caries as a Factor.

Again, there must be no loss of tooth structure on approximal surfaces, for the full mesio-distal diameters of the deciduous teeth are necessary to retain the spaces for the permanent teeth which are to follow. Hence the great need of pointing out to the general practitioner the importance of this first dentition which, even though transitory, must perform its full function. The treatment of such possible loss of approximal surfaces, of course, is evident, namely to restore all loss by fully contouring teeth fillings (Figs. 5 and 6).

Adenoids as a Factor.

When there is a pathological condition in the naso-pharynx, such as adenoids, we know that the induced mouth breathing is a prime factor in the disturbances of normal developmental conditions both in the nose and dental arches. The treatment of such abnormal conditions always consists in first removing the cause, at whatever age they might appear, and then restoring the dental arches to normal (Figs. 7, 8 and 9).

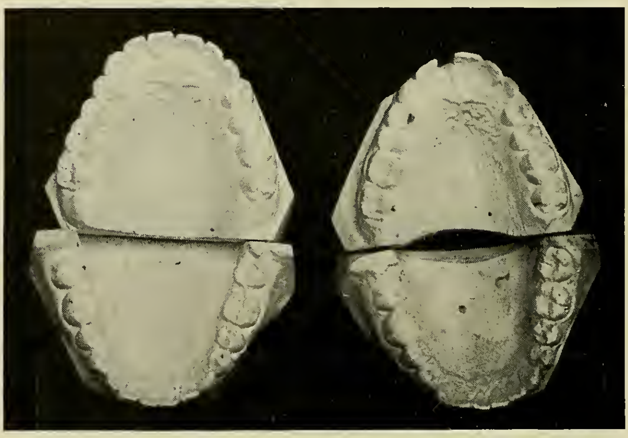


FIG. 14.
Occlusal aspect showing general expansion.

Enlarged Tonsils as a Factor.

When the tonsils become hypertrophied we find the child forming the habit of throwing the chin forward, to aid him in breathing, especially if he should have polypi, enlarged turbinates or adenoids. In course of time we find the jaws locked forward, and thus falling into Class III (Angle classification). The treatment here is similar to the above class, namely, remove pathological cause and restore the dental arches to normal (Figs. 10, 11 and 12).

Habits as a Factor.

It is not generally believed that the habits of thumb sucking, lip biting or resting the tongue between the jaws in the deciduous dentition have much bearing on the permanent teeth; nevertheless we often see the habits thus formed in babyhood carried up into childhood with all the attending evils. Safe treatment would be to break the habit whenever the tendency appears (Fig. 16 *c*).

Non-Eruption and Tardy Eruption.

Nature, for some unaccountable reason, at times fails to supply a tooth germ for a permanent tooth. There is always a shifting in occlusion as a result when this space is not preserved (Figs. 13, 14 and 15).

For diagnosis in dealing with this the X ray is our only recourse.

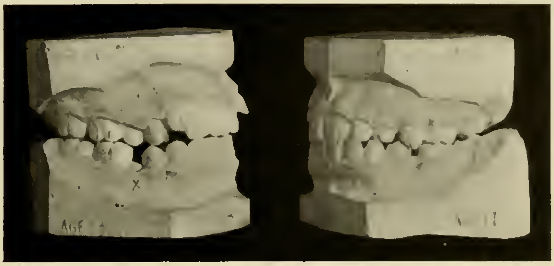


FIG. 15 *b*.

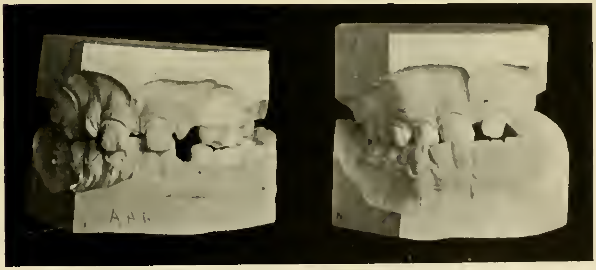


FIG. 15 *a*.

(*a*) Two cases in tardy eruption. The X ray shows two bicuspids in patient, age eleven. (*b*) Abnormal frenum on the left. Tardy eruption of upper cuspid and central. Notice lingual occlusion of incisors.

Loss of Permanent Teeth.

What has been said of the deciduous teeth in their loss shortening up the arches and causing malocclusion can be similarly applied to the loss of permanent teeth in the second dentition.

Accidents as a Factor.

As the result of an automobile accident at the age of three and a half a young miss lost one of her central incisors. Within a few months the space was entirely closed. What serious trouble would surely follow if this crowded condition were not relieved at the proper age (Figs. 2 and 3 *c*).

Abnormal Frenum as a Factor.

This condition is best treated in early childhood soon after the eruption of the permanent centrals (Fig. 15 *b*). The treatment consists in operating upon and cutting out the frenum and cauterizing, bringing the central incisors together and retaining by two plain bands united. The harm of waiting is apparent.

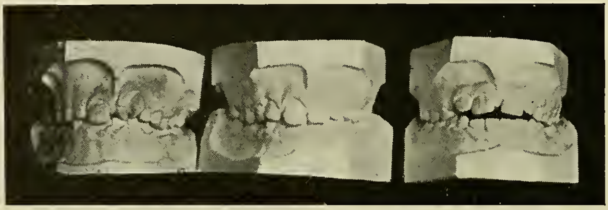


FIG. 16.

(*a*) Supernumerary and abnormal frenum. (*b*) After removing same. (*c*) Habit of resting tongue between teeth, showing depressed lower incisors; case also illustrates abnormal frenum.

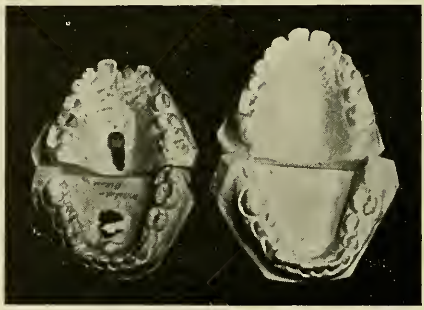


FIG. 17.

Occlusal aspect, showing before and after treatment for supernumerary.

Supernumeraries as a Factor.

It is but logical to remove supernumeraries as soon as possible in order that they may not occupy any room needed by the teeth in normal occlusion. The X ray is of use in diagnosis in these cases (Figs. 16 and 17).

Diet.

Our manner of living has a great deal to do with our development, and how true it is that civilization has brought this curse of "all kinds of prepared foods" to lessen the muscular development around the mouth. All we do is to add water and serve, and at times we often leave the water out; "milk sops" one of our number is pleased to call the whole race.

Improper using of our teeth in not chewing our foods makes the alveolar process a much inferior structure. In fact, may we not attribute the success of those practicing prophylaxis to the fact that they insist on their patients using their teeth for chewing purposes, while at the same time they stimulate healthy conditions in the surrounding structure by massaging the teeth and gums.

The Indians are good examples of a people who use their teeth properly, and well might we learn a lesson from them in getting back to nature.

Treatment.

For the accomplishment of our work we must have efficient appliances. I feel that I would not be true to myself if I did not make a statement as to what I have been using, and also to say "that no man practicing orthodontia is true to himself or his patients who works to the exclusion of removable appliances." Mark you, I say "exclusion," for we all realize that the fixed appliances permitting of the almost limitless uses of the "Baker anchorage" have revolutionized our practice and permit us to do almost anything and everything; nevertheless, there is a place for everything and anything that is good.

For three months I gave a case my best attention and thoughts, and in despair turned to a book sent to me by its publishers, and with a removable appliance therein described I accomplished the work in less than two weeks. Was it not worth while? For simple cases in lingual or buccal occlusion (not torsal), and for retention I find the removable appliance admirable in many instances.

For the treatment of cases due to lack of development in the anterior portion of the mouth, we can use the method of Dr. Angle; namely, the lower deciduous cuspids are banded with plain bands and united by (G) wire (German silver annealed) lingually to the incisors. This soft G wire is to be pinched or stretched by a pair of pliers, after Dr. Angle's pattern, and thereby we gain the needed space for the oncoming permanent incisors.

An efficient method of spreading the lower arch and depending on it in turn working through the occlusal planes, to carry the upper with it, is by use of the jack-screw, attached to plain bands on the cuspids at the disto-linguo-gingival angles. These same bands have lugs of iridio-platinum along the first and second molars at their gum margins. The nut of the jack-screw should be tightened not oftener than one turn in two weeks.

I have also used the Jackson removable appliances to advantage.

And last, but not least, the child's size, expansion arch, which is known too well to need any comment.

Discussion.

Dr. C. A. Hawley. This is one of the very valuable papers presented at this meeting, and is worthy of a great deal of discussion. The trend of every paper presented here has been toward the value of early treatment, the subject which Dr. Flint has chosen. The first part of his paper was a well written resume of the causes of early malocclusion. I have but one comment on that part, and that is to emphasize the necessity of education. Here is a means of educating patients that should not be overlooked. Every patient should be returned to the general practitioner after being referred to the orthodontist, a far better patient than before he came. It only requires a few remarks now and then to accomplish the desired result. The dental practitioner will appreciate that, and it will help to make harmony. An orthodontist will become a very valuable man in a dental community in that way, and wherever cases are referred to him he will better the practice of the dentists.

I am sorry I have not more time in which to discuss the practical part of early treatment. Every tendency toward distal occlusion should be treated at once: every tendency toward mesial occlusion should be treated at once, and all lack of development should be treated.

Dr. Flint rather apologized for the use of appliances not connected with the expansion arch. I think this is a great mistake. When the expansion arch was perfected, the evolution of appliances was not completed. There are many other things that are good; why should we have any hesitancy in discussing them before this society? I am sorry the appliances were not presented more in detail. The subject of the development of the arches, the appliances and the retention also, should receive close attention in the future. I myself have in most cases used the expansion arch; a small arch of eighteen gauge gold wire has done very well; but I appreciate that in many cases the Ainsworth or Jackson appliances might be better, and certainly there need be no hesitancy in using them.

As to the Ainsworth appliance, spoken of by Dr. Barnes and others, the statement has been made that it does not tip the teeth, but carries them bodily. I may say that I have not yet seen an appliance that would affect any more than the one tooth that is banded. I think the lingual spur would tip these teeth that were not banded as much as in cases where ligatures are used. If the second bicuspid tooth, in a mature case, is banded and the Ainsworth appliance used--that tooth may not be tipped, but the cuspid and first molar will be moved by the lingual spur.

By what mechanical principle do they fail to tip, just as when the expansion arch is used? There may be some reason, but I can not see it.

The retention of cases in early life is one of the most serious considerations, because a child has many things to contend with, and its habits are not always regular. There is more difficulty in keeping retaining appliances in place than when the patient is an older person. The treatment must not be considered as absolutely final when it is expected to be so. I have many cases where I have developed the arch according to my measurement of the teeth, where I really believe I have attained final results. I believe the stimulation of the process and the more regular shedding of the temporary teeth will cause the normal eruption of all the permanent teeth. However, I could not promise a patient that there would not be some future adjustment required, as I am not sure of it myself.

Dr. Gray. The subject of Dr. Flint's paper is of especial interest to me, as indeed it must be to all who are engaged in the practice of orthodontia.

We are almost daily called upon to combat the erroneous beliefs of men engaged in the practice of dentistry and medicine, to say nothing of the uneducated laity, with reference to the proper time for treating maloccluded teeth. I believe the fallacious teaching that this treatment should be deferred until the permanent dentition is completed, can only be promulgated by those who study the subject superficially, if indeed they have had the advantage of preparation for, or any considerable experience in the practice of orthodontia.

Some of the chief objections advanced to early treatment have been—

1. Why interfere, when nature will take care of the trouble in her own way.

2. The pain attending early treatment is severe.

3. Wait until the permanent teeth are all erupted, as until that time there may continue to arise certain conditions of malocclusion, no matter what previous treatment has been used.

I need not reply to these objections singly. Suffice it to say that the advantages of treating these dental deformities in their incipiency are so great and so important that they far overshadow any possible disadvantages. How much better to gently guide the teeth toward the normal than it is to allow the case to progress to a condition of serious malocclusion! How much tedious work is thus saved! How great does early treatment favor the complete and harmonious development of the dental apparatus, the nasal cavities and their accessory sinuses—and, dependent upon all of this is the symmetry and beauty of the face.

A recent case in my own practice has done much to strengthen me in my belief that many of the objections to early treatment are wholly unfounded. The little girl had recently undergone a number of surgical operations, some of them of a major character—leaving her in a delicate condition of health. The parents were a little skeptical as to the influence of my treatment on their daughter's health, but were pleased to note, as the work progressed, that the child was inconvenienced but little, and indeed seemed to gain in strength all the while.

I must compliment Dr. Flint upon several particularly interesting points to which he ascribes much importance. Many times we can indicate the requirements of treatment to dentists who seek our advice, as well as to parents. As to the position of instructor in the dental school, looking at it from Dr. Flint's standpoint, I confess it would almost seem a duty to avail ourselves of such opportunities of instructing dental students.

In the case of premature loss of deciduous molars, Dr. Flint suggests that lip pressure pushes the anterior teeth back. My opinion is that it is rather the rapid movement, forward, of the teeth posterior to the space of the lost tooth. And again, in mouth breathing cases, does not the abnormal tension of the cheek muscles *present normal widening* of the arches, rather than absolutely contract them?

Dr. Varney Barnes. The importance and value of early orthodontic treatment has long been recognized. S. H. Guilford, in 1859 ("American System of Dentistry"), advised it as essential—and yet modified his advice to suit the mechanical limit of the times. To-day no rational orthodontist can do otherwise than practice and advise early treatment.

Early treatment does prevent malocclusion. It is easier for the patient and operator, and the possible results are infinitely better than might be obtained by delayed treatment. It links in with modern thought—assisting, guiding and permitting nature to develop a normal dental apparatus, and of course betters the neighboring tissues. It must not be supposed that merely enlarging the temporary arches prevents all irregularity. The earlier the pressure is applied to the temporary teeth the greater the influence for preventing irregularities.

Yet beneath small temporary arches the permanent teeth have been forming in cramped quarters *for years*. If full room be provided for their eruption they will come into place far better for it, but may still be irregularly placed and may require more or less treatment from time to time as they erupt. This means that we should treat the little dental cripples as early as we can handle the patient without deleterious physical results. It means that we should expand arches as fully as possible in the first treatment; that the pressure should be applied through the temporary teeth, while their roots are practically unabsorbed. It means that there should be a minimum of distal pressure, which would cause a distal location of the entire dental arch. It means that the horizontal hinge arch appliances should not be used without attachments to prevent the buccal inclination of the molar crowns.

The Ainsworth principle should be embodied in the apparatus, so that the temporary teeth may carry out with them, bodily, the permanent teeth beneath. The teeth should carry the alveoli and maxillæ with them. This means the opening of the intermaxillary suture, its filling in with new bone and the restoration of the palatal arch where development stopped in the growth of the intermaxillaries in the first place. With this treatment comes, primarily, the best vertical inclination of the buccal teeth and the elimination of many of the hindrances to the proper placing of the incisors.

Early treatment means care of the patient from possibly three or four years of age, off and on, to from thirteen to sixteen or later, dependent upon the kind of case and the health of the patient. The treatment periods are short for the very young. Sometimes but one treatment period is required, with long retention and watching. Generally, however, many treatments are necessary to guide the permanent teeth into place. The retention must be light, strong and comfortable, and has the advantage of being applied to the temporary teeth. Constant watching is necessary to permit the removal of temporary teeth, as their roots absorb, and to maintain the arches for the eruption of the permanent teeth.

If the growth spaces are not sufficient at from four to five years of age, it is better to expand, for here lies the secret of crowded teeth that are almost correct, yet with deficient interproximal spaces and normal gum tissues. The growth spaces must be equal to the central, lateral and cuspid, *plus* what may be necessary to make the width of the succeeding permanent teeth. The space distal to the cuspid is just as essential, perhaps more, than the others, and I believe the lower spaces are more essential, if that is possible, the reason being that the lower teeth erupt first. If they be too far distal, as they would be without the proper growth spaces—the incisors and cuspids would elongate to contact with the opposing teeth or gums, producing close bites. I have casts of many cases of younger and older brothers and sisters, showing these abnormalities and their formation.

If there is irregularity in size or shape of the dental arch, operate! Prevent, and do not trust to nature to do something for which the development period has long passed.

Early treatment promotes better prophylactic care of the teeth, filling of small cavities and the insurance that there are no interproximal cavities when your operations are completed. Habits are baneful to a *limited extent.* They may aggravate or localize a deformity that is caused by other reasons. Lip pressure is a minimum factor. What has been said to be a lip pressure deformity is really the distal location of the incisors due to their encroaching upon the space of the cuspids in undeveloped jaws.

Now, in regard to early treatment, we can diagnose early, so early as to definitely diagnose malformations or under developments before any teeth appear, or before the molars appear. Our field is to regulate the teeth and provide a sufficient jaw development to hold them; therefore, our basis is the jaw, upon which the alveoli and teeth are situated. We treat irregularity or malformation of teeth and alveoli and jaws to prevent the terminal result—malocclusion. We regulate the jaws. Then let us diagnose tooth and jaw irregularity; not merely malocclusion. Then will come a clearer conception of conditions to be remedied. The earlier the jaws are influenced the better the opportunity of maintaining normal occlusion and all that it means.

Dr. D. Willard Flint. As to the development that is about to take place in the jaws of these young children, I think we have no right to interpret what nature is going to do at a stated period. At two years of age I do not believe we can possibly say what development there will be at the age of five. In the spring of the year we expect to find blossoms; not fruit.

By Pittsburg time it is 3.18, we are all hungry, and the most acceptable sound would be the dinner bell, therefore I will say no more.

What Can Oral Prophylaxis and Orthodontia do for Each Other?

By N. S. Hoff, D.D.S.

I have no instruction from your programme committee as to what phase of the general subject I should discuss, and I hesitate to present the subject at all because so much has already been written upon it for the general profession, and because you had it so ably presented at your last meeting. There are, however, some phases which have not been sufficiently emphasized, it seems to me, and with the hope that I may not weary you unduly, I shall try to offer them in my way for your consideration.

I shall ask your consideration of three propositions, that you may determine whether oral prophylaxis has any relation to them and the principles or practice of orthodontia, and I claim the privilege of utilizing all operative and prosthetic procedures which may be employed in securing complete oral prophylaxis.

Is Prevention of Malocclusion Possible?

First: Can oral prophylaxis as at present practiced be made an important factor in the normal development of the teeth and their surrounding structures, rendering orthodontic interference unnecessary or less difficult?

I shall not take much of your time to remind you that one of the cardinal principles of your art should be to begin your work at the earliest period practicable, and that like all other branches of the healing art, prevention of deformities is as much a department of your work as correction. If this premise is acceptable, you should enlarge your sphere of influence to include the supervision of the first, as well as the succeeding dentitions. Modesty may cause some of you to hesitate to claim this, but I predict that in the near future your best work will be done in conferring with mothers of infants as to the best measures to be adopted to secure a normal development of the teeth and jaws of the first dentition.

By all the principles of logic and reason this work ought to fall to the lot of the orthodontist, since it is his business not only to correct the mistakes of nature, but to present to the practitioner of surgical and prosthetic dentistry the teeth in as perfect a state of development as possible. The business of the general practitioner of dentistry is with the prevention and repair of the ravages of disease of the teeth and their environment.

It is only recently that we have begun to notice that many deciduous dentures are abnormal as to development of the teeth and their positions in the arches. Very few orthodontists, however, have had the courage to suggest, or have offered to apply treatment for their correction. It is generally considered hardly worth while to take the trouble to interfere with these conditions, considering their brief existence. But when we come to consider the influence which these deciduous dentures have in casting the form as well as structure of the more durable second denture, I believe that we will conclude that it is well worth our while to make sure that the way for the normal development of the permanent denture is made as clear and as easy as possible.

To some extent we have tried to educate people to take care of the first dentition by prescribing a suitable mouth toilet, but this is usually so carelessly done by the dentist that it makes no serious impression on the mother, and nothing adequate is done until some of the deciduous teeth begin to decay and the child complains of toothache when he eats candy. He is then taken to the dentist, who says: "We will fill that tooth with a little cement, or amalgam, which will stop the ache until the tooth is replaced by the permanent one." Is not this the practice generally? There may be a few dentists who are somewhat more thoughtful and take pains to repair damages in such a way as to not only conserve the tooth, but to completely restore its function.

I am not able to supply statistics which would prove beyond doubt that many cases of malocclusion in the permanent dentures are largely the result of lack of proper care of the deciduous dentures, but I can not help believing that if more pains were taken to secure perfect deciduous dentures and to preserve them in perfect condition until the proper time for their removal had arrived, we should have less malocclusion of permanent teeth.

But what has oral prophylaxis to offer that will encourage the orthodontist to begin his work at a period where he should be able to produce the most perfect results?

When we read Dr. Smith's statements a few years ago to the effect that by periodically polishing the teeth and by regular and systematic care by the patient he was able to remove pigments that seemed permanently established in the enamel, and that there was a new life force in the pulp and peridental structures, we thought he was a dreamer, and we had little faith to believe. After seeing actual results in a large number of cases, we became convinced that there was truth in his statements and we were encouraged to experiment for ourselves. Three years of practice and observation have convinced us that much can be accomplished by the so called prophylaxis measures in restoring the vital functions of the oral tissues, by systematic massage and cleanliness in the mouths of patients far past the constructive age in life. More recently it has come to us that if old and diseased tissues can be revived by a carefully applied system of cleanliness and stimulation why should not a similar treatment be valuable in encouraging a better development of the growing structures. We have as yet not gone back as far as the cradle, but we are working in that direction. In the few cases that we have had under observation we are confident that an early application of the system of oral prophylaxis has had the most beneficial influence, not only in retarding and preventing decay of the teeth, but we believe a good influence toward better development of the permanent teeth and jaws has resulted. Of course, the time and opportunity at our disposal has been insufficient to enable us to make positive statements; but I really believe that by careful application of the principles of oral prophylaxis, beginning with the eruption of the first deciduous tooth, it would be entirely practicable to carry any child through to complete permanent dentition without other surgical or orthodontic interference. Such a proceeding might interfere with our present business methods and practice, but I am sure our efforts would be more cordially appreciated and our art greatly ennobled. A research to prove this hypothesis would be difficult, because of the time necessarily involved, as well as other obvious conditions. Its results, however, would be of immense value, and it is a point that I trust you may keep under observation.

There is no question, however, but that while cases are under treatment some more adequate method of cleanliness and stimulation should be found. The expedients now used for cleaning the teeth and appliances of incidental and extraneous deposits are obviously necessary, but insufficient. A systematic application of oral prophylaxis, that is the polishing of the teeth and stimulation of the gums and peridental membrane at frequent intervals, should encourage the formation of new repair tissue and render retention by mechanical fixtures less mandatory. The appliances at present in use render this somewhat difficult, but by keeping in mind the necessity for this treatment, it is not difficult to devise methods of applying bands, arches and ligatures in such a way as to accomplish needed movements and at the same time leave opportunity for the proper application of the prophylaxis treatment, and the regular use by the patient of the brush and powder, or disinfecting mouth washes. But this leads us to the second division of our subject.

Prophylaxis during Treatment.

Second.—Can prophylaxis methods offer anything helpful during treatment for correction of malocclusion? Every one who has practiced orthodontia, using the various forms of fixed appliances, has been compelled to devise new ways of cleaning the teeth and appliances, and while many effective methods are now in use, a careful inspection of most mouths undergoing treatment will reveal diseased conditions of the gums, if not incipient caries, in spite of all efforts at cleanliness by the patient operator. We are not sure but that modern orthodontic appliances can be indicted seriously because of the unsanitary conditions they create. With these appliances the regular cleansing of the teeth by the usual tooth brush and powder in many instances is impracticable, and resort is had to antiseptic mouth washes, because they can be applied without danger of disturbing the delicately adjusted ligatures and arches. While these are helpful and convenient for use, they are in most cases insufficient. We were greatly interested in the presentation of the method of sterilization made by Dr. Ferris at the meeting last year, and trust that in the discussion those who have made considerable use of it will report results. The method is undoubtedly effective, but can never be sufficient, because it cannot be applied by the patient, nor conveniently at sufficiently frequent intervals to secure the best results. Another objection to depending upon such a measure is that it does not thoroughly remove the material which it disinfects, nor leave the appliances in the best condition to prevent subsequent deposits. Too frequent application of this remedy, like other liquid disinfectants used in the mouth, leads to serious irritation of the mucous membrane and disastrous results. It has been found that the less chemical remedies used in the prophylaxis treatment of the gums, the better the healing process takes place, and we shall find that although good disinfection and a degree of cleansing is produced by forcibly spraying these alkaline chemicals into the mouth, that, unless great care is exercised, injurious, rather than beneficial, results will follow. The great difficulty which confronts us is due to the celerity with which reinfection takes place, because of the exposure inevitable in the mouth, which fortunately is to some extent counteracted by the restraining influence of the saliva when it is in a normal condition, and the practical impossibility of sufficiently frequent application of antiseptic solutions to control the tendency to recurrent unhygienic conditions. We are not prepared to offer a satisfactory solution of this problem, but believe that much can be done to prevent unfavorable results by means that we can devise and control and which may be put into the hands of the patients with safety.

In the first place we would suggest that before any case of malocclusion is put under treatment the mouth should be given a thorough prophylaxis treatment, including the filling of all decayed teeth with a durable material and in a thorough manner. The appliance should be devised with an idea of making it practicable for the patient to accomplish thorough cleanliness by the frequent use of ordinary mouth toilet preparations. All bands should be accurately adjusted, the arches fitted so they will withstand considerable manipulation by a tooth brush without losing their adjustment and effectiveness. The ligatures especially should be adjusted firmly and the free ends secured so that they will not become loosened nor serve as places for the collection of deposits of food, etc., and above all every tooth should be approachable for thorough polishing on all of its exposed surfaces. The bands, arches and ligatures should be rendered cleanable. This can be accomplished in almost every case where metal appliances are employed. The rubber bands, silk or linen ligatures are unsanitary and need frequent renewals if used, as they are incapable of sterilization; threaded arches are objectionable as they afford lodgment for deposits; in fact, all the appliances and adjustments should be made as nearly self cleansing as practicable. Once each week, or oftener if necessary, the mouth should have a prophylaxis treatment, and every unclean spot pointed out to the patient for especial attention. The patient's duty should be to keep the mouth clean during the intervals of absence from the office by such means as may be effective. We find the best means is by the constant use of a good tooth powder and a soft brush. A powder should be provided that is not strongly alkaline nor in other ways much medicated, and which is abrasive and yet soluble. The following formula will serve as a basis and can be modified to meet varying conditions.

Precipitated chalk	60 parts
Magnesium carbonate	20 parts
Pulverized sugar	10 parts
Powdered soap tree bark	5 parts
Bicarbonate of soda if indicated	5 parts

To this may be added small proportions of any of the flavoring essential oils. It may be made astringent by the addition of 2 per cent. of myrrh, or antiseptic by oil of cassia or carbolic acid. No coloring matter should be added. Patient should be instructed to use this freely morning and night, using a fine bristle tooth brush which has stood in water long enough to make it pliable, or a badger's hair brush will answer. Instruct patient to take a teaspoonful of powder in the palm of the hand and after wetting the brush to incorporate the powder completely into the bristles and brush every portion of the teeth, and without spitting out the powder, fill the mouth as full of water as possible, reinsert the brush, close the lips, and wash the powder all through the teeth and appliances, holding the head over the wash-basin so the escaping water may run into it. Instruct the patient to take time to do this thoroughly at least twice each day, morning and night preferably. Oxidizing powders, tooth pastes containing resinous essential oils, colored pastes and powders should not be prescribed because of their tendencies to disintegrate or discolor the appliances. Our experience has been that such means can be used practically and with very good results, so far as preventing decay of the teeth or irritable conditions of the gums is concerned. The prophylaxis treatment insures clean teeth and keeps the gums and peridental tissues in the best condition for withstanding the strain of moving teeth.

Third.—Can prophylaxis assist in orthodontic manipulations of teeth in adults?

Treatment of Malocclusion of Adults.

It may seem that it is hardly worth while to discuss such a proposition as this, for the reason that very seldom are the orthodontists asked to interfere in cases of long standing malocclusions; or those which have been acquired in adult life because of diseases which have affected the peridental supports of the roots; or in cases where, because of loss of some teeth, the remaining teeth have drifted into malocclusion.

The science and art of oral prophylaxis has set a higher standard for both operative and prosthetic dentistry than we have known before, and if we are not deceived in its drift, it will demand that the orthodontist of the future must extend his work to the treatment of cases of malocclusion in patients for whom such treatment has been considered impracticable. In many cases where pyorrhea has so affected the alveolar support of the roots as to cause the teeth to assume abnormal prominence or decided malocclusion, we find that after such teeth have received prophylaxis treatment the gums and peridental conditions become healthy; there is a tendency for the teeth to return to their normal positions and relations, and we believe that such teeth, if properly encouraged, would many times of themselves return to normal relations. If they could be brought back by orthodontic force, there is no doubt but that they would resume a good normal function and become valued organs of mastication.

It may be that those of us who have been practicing oral prophylaxis have become over confident and are claiming more than we are justified in doing for this work: but when cases which seemed almost hopeless yield such beautiful results, even after a few days of treatment, and go on improving, it gives us a greater appreciation of the value of the teeth than we have ever before had, and fills one with an enthusiastic desire to save every tooth and to bring all in a perfectly harmonious relationship such as is known only in a perfectly developed set of teeth. With the possibility of eradicating all disease of the structure which supports the roots, and with the modern practicable crown and bridge methods of restoring lost or decaying crowns, to say nothing of the splendid attainments of the present operative procedures, it is possible to make prosthetic restorations of exceedingly high value and of the highest type of esthetic art. Is there not here an orthodontic field that would yield great reward to any one who will take up this pioneer work? Such a broadening of the scope of the orthodontists and prosthodontists would raise the professional standards of all dental practitioners and of every specialty. No one, so far as we know, has put a limit on the age where orthodontic interference should be considered possible. If this has been done, it has been arbitrarily limited and based on experience rather than on data derived from scientific research, hence can not be conclusive. It seems to us that age alone can never be an accurate adjustment of so important a matter. It is too much like the statement made by Dr. Osler that when men get to be sixty years old they should be chloroformed. Some men are not old at seventy, while others lose their usefulness at a much earlier age. It all depends on the man. So it is with teeth to be moved in old age or even young adult life; the decision must rest on actual conditions. We really believe that teeth can be moved at any age up to sixty years or more, provided the gums, teeth and jaws are free from disease.

If we have directed your attention to newer fields of interest and service, and you should feel disposed to enter them, we shall have done all that we could desire. We trust these few hastily prepared suggestions may commend themselves to your judgment, and that working together with the practitioner of oral prophylaxis we may thus extend our entire sphere of work and usefulness.

Discussion.

Dr. O. W. White. This is a subject in which I have been much interested. I wish to speak in regard to the sprays Dr. Ferris gave us last year. I have been using them, and find they are very beneficial to my patients. Instead of the essential oils I use the spirits, which make a better spraying solution. It is almost impossible, in some cases, to remove the appliances under three weeks. If we do so it will require a very great deal of our time. By using these sprays we can put the mouth in as nearly an antiseptic condition as is possible. Dr. Hoff says the bacterial plaques are not removed. They are if we get high pressure with the spray, and with the solutions heated to about 122 degrees you can dissolve those plaques. They become so soft the force of the spray will carry them off, except when under the ligature wires.

Dr. Pullen. What air pressure do you use?

Dr. White. About twenty-eight pounds.

Dr. Pullen. Temperature is a valuable point, is it not?

Dr. White. It is a very valuable point. Temperature and pressure are essential to good results from these solutions, points where the ligature wires and arches come in contact with tooth surface being the only places that require attention after spraying.

In one of our first meetings the subject under discussion brought out a few remarks about deposits on the inner surface of arches. When we realize that all surfaces of the teeth that are not exposed to cleansing activities are coated with the same deposits, is it any wonder that caries thrives in marked cases of malocclusion?

In using the mechanical treatment of oral prophylaxis you are soon able to tell from touch the amount of foreign material deposited on the enamel. It will require more careful treatment in malocclusion cases than where no appliances are in the mouth.

If it is possible to thus dissolve these plaques with sprays, it will save us a great many hours' work which would otherwise necessitate the removal of appliances.

In using these sprays we leave the mouth in an alkaline condition, which is a better field for bacteria to grow in than if we leave it in a neutral or acid condition. Is there not something else we might use to bring it into a neutral condition?

Dr. Casto. For several months I have used the sprays recommended by Dr. Ferris. I have used them in accordance with Dr. White's suggestions with very pleasing and satisfactory results.

Regarding the care of the appliances, I remove the arches quite often for cleansing and repolishing, probably on an average of once in three weeks. I also remove the bands when I think they are not in a proper condition after a careful examination has been made. In no case do I allow bands to remain on the teeth more than a year without being removed and replaced.

Dr. Hawley. How long would you allow a well cemented iridio-platinum band to remain on a tooth?

Dr. Casto. I would not say. Sometimes when you have apparently done the work perfectly it might be defective. If I am not satisfied after a careful examination I remove the band.

Dr. Kemple. Do you find your suspicions justified after removing these bands?

Dr. Casto. I have never found any trouble. There might have been trouble in some cases if the bands had remained in place longer.

THE AMERICAN SOCIETY OF ORTHODONTISTS

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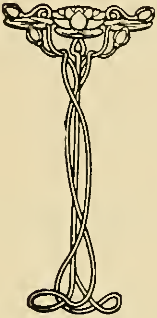
1908

EIGHTH ANNUAL MEETING HELD AT
WASHINGTON, D. C., NOVEMBER 5th,
6th, 7th, NINETEEN HUNDRED EIGHT

THE AMERICAN SOCIETY OF ORTHODONTISTS



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Dates and Places of Meetings of The American Society of Orthodontists

First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903, January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30, and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

Table of Contents

Address

Honorable H. B. F. MacFarland 5

President's Address

C. A. Hawley, D.D.S. 9

Some Suggestions on the Management of Cases of Malocclusion Associated with Mouth Breathing

Milton T. Watson, D.D.S. 17

A Consideration of Infra-occlusion

Dr. Alfred P. Rogers 27

Base Metal versus Noble Metal Appliances in Orthodontia

Clarence Jones Grieves, D.D.S. 45

The Influence of the Premaxillæ upon the Form of the Hard Palate and upon the Septum

Harris Peyton Mosher, M.D. 85

Evidence and Significance of Tooth Eruption

Varney E. Barnes, D.D.S. 123

Treatment of the Displacement of the Inferior Maxilla, Caused by the Partial Resection of the Body of the Bone

Dr. Jose J. Rojo 145

A Consideration of the Temporo-Mandibular Region

S. Merrill Weeks, D.D.S. 157

American Society of Orthodontists.

Address of Honorable H. B. F. Macfarland, President Board of Commissioners, Washington, D. C.

Mr. President: It is my happy privilege to welcome many conventions to Washington on behalf of the government of the national capital. I think we have at least one each day the year through. I assure you I welcome this convention with especial gratification, because we know how important your work is to the whole community. It is especially gratifying to know you have representatives here from Mexico. Germany and Australia. It is an international gathering. As this is the national capital it is especially appropriate that you should meet here, because of the international character of the convention and because of your members who are of our own household.

We have no keys to offer you, because we have no gates. All are welcome at all times. Neither do we have to offer you the freedom of the city. All Americans are born free, and are citizens here by right of their birth. Those from other lands are made to feel they are adopted into the family for the time being. Our great desire is that all of you should feel perfectly at home here.

We covet the interest of those who are Americans in all the development, upbuilding and beautification of the common national capital. We believe that every time you come here you go away richer in your patriotism, and are more desirous than ever before to have the national

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capital made all that it ought to be, physically, and in its laws and customs. In your profession your object is to raise the ideals to the highest scientific plane, and you gentlemen of science will unquestionably have a great effect upon the work of your profession in Washington. At the same time, we believe and expect you will feel, after you have been here, that your coming has been of benefit to you. You will not only see the President of the United States and others in high authority in the nation, but you will be especially interested in some of the scientific collections and the great Library of Congress, and in the other things which draw scholars and men of science from all over the world to Washington. When you go away from Washington, assure your Senators and Representatives of your cordial interest in all they do for the development of the national capital. We who live here—three hundred and thirty thousand people, one-third of them colored (the largest colored population in the world)—are glad and proud of our right and privilege to pay one-half of the maintenance of the national capital, and the rest of you pay the other half. We pay sixteen dollars apiece and the rest of you pay about six cents apiece. I am sure you would be willing to double it if you had the opportunity! Certainly you want this capital to be worthy of this country, and as the country grows you want to see the capital grow in proportion so that when our friends come from abroad they may see here, as it were, a symbol and a sample of the whole country, and may appreciate at once the real greatness, the true greatness, of the United States.

We are heartily glad to have you here, and hope you will greatly enjoy your visit. We hope your deliberations will be profitable to you, and are sure they will be profitable to the members of the profession in our city. We are fortunate in having some men here worthy of the best traditions of the profession, and in whose skill and scientific ability we repose the utmost confidence. They, and the younger members of the profession especially, will be greatly benefited by your presence.

Dr. Ottolengui.

Mr. President and Gentlemen: I feel, in a certain sense, honored by this call on the part of the President. I had no idea when I succeeded in getting the Honorable Mr. Macfarland to speak to us, that I was, in a sense, setting a trap for myself.

We are very glad to be here; we are glad to come to the capital of the nation, and we would be very glad, indeed, if we were privileged to do so, to pay the sixteen dollars and allow the disfranchised citizens of this city to pay the six cents! I understand now that there is some little advantage in not being permitted to vote here, because every man I have met has told me that had he been allowed to vote he would have voted for the winning ticket. It is pleasant to feel that the man you wanted got elected, and to realize that you have not committed yourself by voting the other way. That is one advantage which I hope will compensate for the loss of the voting power. On the other hand, there is another great advantage about living in Washington, *i. e.*, you are living in what is already the city beautiful. It is the only city, I think, in the United States having a law which prevents the building of ugly buildings. In that sense you have an advantage over New York. It is delightful to see that every new addition to the city is a little more beautiful and artistic; an evidence of the growing character and refinement of the country.

It may not be amiss to say one word to the Commissioner so that he may excuse us from the seeming discourtesy of a small audience. We want him to know we are a small body of men; that it is not possible to have an attendance of two or three thousand with a membership of less than a hundred, but it is a well-known fact that science has never been advanced by the operations of the mob, and the reason why this society was organized was because the few earnest workers in the field found they were lost in the "mob" at dental conventions, and they have separated themselves and their work from the dental profession without losing their allegiance to the profession—simply that they might specialize. The art, in that sense, is young, but in fifty years from now, if the Commissioner will come and give us another address, we can promise him an audience of two thousand.

I thank the Commissioner on behalf of the society and guests for extending the very hearty welcome to the City of Washington.

Dr. Jose J. Rojo, Mexico.

I have belonged to the society for a long time, and do not lose a chance of reading the papers as published in the ITEMS OF INTEREST complete. I want to say to you that it is the seven or eight thousand kilometers which keeps me away from you, and does not allow me to come as often as I wish. Nevertheless, I am constantly in touch with the work of the society, and most of my time is devoted to the special practice of orthodontia. All of my friends who are familiar with the progress of orthodontia, and especially those who know of the American Society of Orthodontists, send their hearty greetings and best wishes to this Congress, believing that your work will be in the interest of the advancement of the science of orthodontia.

President's Address.

C. A. Hawley, D.D.S., Washington, D. C.

It is my most pleasant duty to greet you on the occasion of the opening of this eighth annual session of this society. For the honor conferred upon me, and for the pleasure of presiding at this meeting, I most heartily thank you.

The society is nearing the close of the first decade of its existence, its organization being co-incident with the ushering in of the twentieth century. Many of its aims have been already accomplished; many of the early difficulties have been overcome, and we can look forward with assurance that history will regard the work of orthodontia as one of the main features of the twentieth century progress in the perfection of the human race.

Why not? Do not the abnormal conditions that surround the etiology of malocclusion strike at the very vitals of the welfare of the human being? Any derangement of the dental arch detracts to that extent from the efficiency of the masticatory process which is essential to the proper preparation of food. The derangement of the dental arch is accompanied with narrowing of the nasal passages, with the usual accompaniment of pathological conditions and obstructed breathing. Without nourishment of the body by food and oxygenation of the blood by air, the body cannot exist. These conditions that accompany malocclusion of the teeth are seriously detrimental to both, and thus seriously affect the growth of both physical and mental welfare of the individual.

Without arguing the question at any length, I assume that you all agree with me that the tendency of recent thought is toward the view that, in a broad sense, malocclusion is a result of a lack of development, arrest of development or faulty nutrition. Investigation of the teeth of primitive races shows that in the state of barbarism the teeth and arches were practically perfect. In changing from the state of barbarism into civilization the food habits have been changed, and with that change in the character and preparation of food has come disaster to the teeth. The profession of dentistry was built on that disaster. The change in character of food favored caries of the teeth, and their defective condition more and more encouraged such preparation of food as would not require their use until generation after generation the tissues have lost their strength and tone. The condition has been intensified by the lack of use of these organs through the growing period of life in children of the present day. While we have left the former point of view of the influence of heredity in the etiology of malocclusion, it is my opinion that we must come back to another and broader view of its influence in these conditions. Undoubtedly, the change from an active out-of-door life in our more primitive state to the sedentary life of the present day has produced a similar effect on the bony tissues of the nasal passages, and coincidentally we have the increase in the pathological affections of these tissues and faulty habits of breathing. These two causes are so interwoven and interdependent of each other that it is difficult to assign to each its separate place in the etiology of malocclusion.

Influence of Use upon the Dental Arches.

During the year a most valuable contribution to this subject has been made in the report of Dr. Louis Ottofy, on the teeth of the Igorots. While his investigation may possibly reveal nothing that was not believed to be true of all primitive people, yet the fact that they exist to-day and may be studied at first hand gives them great value. They are living in the most primitive condition, unaffected by either the benefits or vices of civilization. The examination of their teeth showed an almost perfect condition, there being no malocclusion, and their arches perfect. There are only two per cent. of the teeth decayed as compared with about twenty per cent. in the civilized races.

Dr. Ottofy gives two reasons for the perfect condition of the teeth of these people; first, the open air life which they live, and their consequent physical vigor; second, the character of the food, which necessitates thorough mastication. The Igorots live, for the most part, on rice and *camotes,* a kind of sweet potato. They are neither of them cooked to the point of disintegration, but impose severe work upon the teeth. The use of such food begins as soon as the temporary teeth erupt and are ready for use. The children are also in the habit of constantly chewing rice between meals.

For myself I may say that the results here shown have added weight, because in my own observation among my patients, all of the cases of perfect arches that I have found give a history of some unusual use of the teeth, and most of them were inveterate gum chewers. Within the year a girl of fourteen was brought to me with one of the best developed dentures it has ever been my pleasure to see. Investigation of the case developed that narrow arches and impending irregularity had been pointed out to the mother seven years before, with the advice that the diet should consist, as much as possible, of food that required thorough mastication, and the advice was strictly followed, with the happy result described.

If these deductions are true, then the important question before a civilized people is: First, "Are these conditions that have caused a degeneration of the jaws of the face capable of a sweeping change, and are the changes such as can be incorporated into a civilized life?" In other words, "Must we return to barbarism?"

So far as the question of a greater amount of open air life is concerned, it has already been shown conclusively in the treatment of tuberculosis that more open air living is necessary, not only to rid us of that "scourge of civilization," but for the healthy life of all people, whether in danger of that disease or not; and that no return to barbarism is necessary, but that the required conditions are even better carried out with the necessary modifications of our present mode of living.

So also in regard to the teeth, no return to barbarism is necessary, but *there must be a radical change in the selection and preparation of the food of a child until the denture is complete.* The medical profession have perfectly worked out the necessary component parts of the food of infants and children, so far as the proportion of proteid carbohydrates and fats are concerned, but have totally neglected its preparation, or rather selection, with a view to the development of the teeth and jaws. And here we have great encouragement in the fact that food experts are recommending largely more natural foods, many uncooked and requiring thorough mastication, recognizing from the standpoint of assimilation and digestion that complete mastication is essential. We have vastly the advantage of any previous state of civilization in the great variety of foods that will satisfy the requirements of mastication. It is the duty of this society to enforce upon the public attention the necessity of reform in food habits. As a liberal profession we will not do our whole duty if we confine our energy to remedying evils now existing.

Orthodontia has placed a new value upon the teeth. In addition to being organs whose neglect causes pain and brings disease, whose use in mastication gives pleasure, and whose preservation conserves beauty, they have a mission in the development of the face which must be understood and recognized. The establishment of this recognition is the mission of orthodontia.

The teeth are the only organs in this region whose position can be accurately determined. By long observation of perfect specimens we know the normal form of the arch, and by measuring the teeth we can determine geometrically that perfect form for any given case.

By the facts of normal occlusion we know the relation of one jaw to the other. The teeth, then, form a standard of development for the maxillary bones, mandible, nasal passages, and all the continguous tissues. Their roots set deeply in the maxillary bones, are the only levers by which, through forces applied to their crowns, abnormal positions of these bones can be remedied.

When these facts are properly understood, the public estimation of the value of the teeth will be tremendously increased, and it will only be when their real value is comprehended that we can hope for the changes in food and habits of life necessary to check the present degeneration.

Dentistry is appreciated and remunerated in direct proportion to the value a people set upon the teeth. Both in the organized society, and in their individual work in a community, the orthodontist possesses the greatest opportunity to teach these truths and thus contribute vastly to the welfare of the dental profession. And it is upon this broad ground that we invite co-operation and support. To my knowledge, no other specialty stands in this unique relation to its profession with such great opportunity of mutual help.

It is with the greatest satisfaction that I call attention to the most excellent programme prepared by the Board of Censors. We must not forget that we will be judged most critically by our practical results, as well as our high aims, and we call attention to the valuable clinics as well as the papers.

In no other specialty is there so great an interchange of patients as in ours. Most of them are young and unsettled in life, and as the period of treatment and retention extends over several years, constant co-operation is necessary. Let us not go home from this meeting without having made the personal acquaintance of every member. Let it be a meeting for the cultivation of good fellowship, as well as scientific attainment.

Discussion of President's Address.

Dr. Robert Dunn. With reference to Dr. Ottofy's article, published within the current year, and especially regarding his comments on the subject of preparation of food for the child during the eruption of the deciduous teeth, I think we will find in further research that therein lies one of the causes of a great many of the conditions of malocclusion with which we meet. I may also add that we can look to the length of time and the manner of using the nursing bottle as a factor in producing a great many cases of Class II. I have given considerable study to malocclusion of the deciduous teeth, but

I am not at present ready to give you anything of importance on this subject. However, I think the point I mention will be worthy of considerable investigation.

Dr. E. A. Bogue. It is a pleasure to know that work is being done in many places along the lines of thought evidenced in Dr. Hawley's address.

Dr. Horlicka, whom we are to hear at this meeting, has lived among the Indians for several months in order to study in the same direction.

In England, Dr. Sim Wallace has been examining into the results of proper feeding of the human animal for some time, and so earnestly is he engaged in doing so along these lines that he has now about one dozen little children being fed as Dr. Hawley has suggested.

Up to the present time those gentlemen have almost uniformly found the temporary teeth in good arrangement, and the bodily strength which has been vouchsafed to each one of these twelve children has seemed to protect them, for not one of them has ever been afflicted with the so-called children's diseases.

It is to be hoped that these experiments in England will show us definitely within the next five or six years the absolute truth of the ideas enunciated by Dr. Wallace, and by our president, that the character of food of civilized races is one of the very largest factors in the health of those races.

We, as civilized people, survive treatment that would kill the savage. It has taken many generations to inure us to clothing, for example. The civilized man can endure, as a rule, more than the savage can, work longer and harder.

On the other hand, put a naked savage into clothing and set him to work, and let him get sweaty, and he is quite likely to die of tuberculosis. The Indians of our western plains, who have been put into houses warmed for the winter, and not provided with modern systems of drainage, are dying off as rapidly as that man could wish who thinks that the only good Indian is a dead Indian.

Dr. Varney E. Barnes. One point in that address struck me forcibly, *i. e.*, the remarks concerning the temporary denture which had been diagnosed as imperfect, and then the statement that seven years later the arch was perfect. I would like to see that mouth five years later and note the third molar positions, for they mark the completion of a perfect arch. Arches may be seemingly perfect back as far as the third molars which are so often far from normal positions. Arches may be nearly perfect in outline, but still be too far posterior. The arch in question has the record of having been imperfect, and as the third molars are not yet in, it is too soon to say that it has become perfect. This case, if followed up, should give us some valuable data in about four or five years on the eruption of all the teeth.

Dr. Burt Abell. Our president has given us something to think about. We know that no reform is brought about except through public sentiment, and while we are a small body we have the sanction of Holy Writ for saying "a little leaven leaveneth the whole lump." We must broaden our ideas of the education of the dear public a little bit, and we have something to work on when we call to mind the fact that there are certain so-called fads becoming more and more prevalent; such as sleeping out of doors, athletic fads, uncooked foods, etc., which are taking a strong grip on the American people. The thought occurred to me that perhaps if we could point out to the parents of these little patients of ours the fact that there had been a mistake made on the part of the mother, possibly in not giving this particular child the proper chance in life, whether it be prenatal or other influences, that it might not be so far amiss. In cases where other children are to be born into the same family, we might thus help to rid them of malocclusion. We have the best and most intelligent people for our patients; they are practical when it comes to teaching them about things we think we know. If there is a preventive of malocclusion in the way of correction of habits of parents, it is our prerogative to point these out.

Dr. Jose J. Rojo. I was delighted with the address of our president, and I know very well that when I read it slowly and carefully I will like it and understand it much better. I wish to say that I do not think simply that mastication, or the lack of mastication, or the exercise it brings about, is the most important factor in irregularities of the teeth. I believe there is one still more important, namely, the inheritance of some disease, such as syphilis. That causes a lack of development of the whole body, thus affording a cause for the irregularities. Besides that, I understand the president to say that we know by studying the normal and anatomical arches, what a normal arch is, and that we may be thus enabled to place the teeth geometrically where they belong. I have been struck with that idea many times, thinking that if the teeth are irregular it depends on a lack of development of the jaw bones. The rules of orthodontia require that we shall not extract the teeth. We are to force the alveolar process to develop to where it should develop, but no more. I think in some of the cases it will be necessary to exercise much judgment to decide what to do; either to place the teeth geometrically where they belong, or do something else, such as extracting one or two teeth. Although I remember well the teaching by Dr. Angle, nevertheless I think it is necessary to take these things into consideration.

Dr. Parker, of Australia. I assure you of my appreciation of the paper of Dr. Hawley. It is one of those papers which require reading and study. I think dentists neglect orthodontia because of a lack of interest. I believe that such a dentist is committing as great a crime as he would be in neglecting a knowledge of antiseptics in his work.

In the course of my reading I remember noticing a remarkable case of a family of seven children. The arches were well developed, and the teeth remarkably free from caries. The eighth child was examined and it was noticed that a terrible condition of irregularity and caries existed. Upon investigation it was learned that this eighth child had been brought up on the bottle, and the previous children had been breast-fed.

Another point Dr. Hawley referred to is the mastication of food. I think teeth were put in the head for use; if not used they are abused, I believe. It is not only the exercise of the teeth, but the exercise of the surrounding parts which helps. In the case of the blacksmith, his arm is developed. The same with the mastication of foods, if the rolling mills do the grinding for the individual, the jaws, teeth and surrounding tissues suffer.

Dr. Ottolengui. I want to touch upon one particular phase of the address of the president: that is co-operation and practicability. We are a small body of specialists at present in this society. What ought to be the future of the society? We have finished our schooling and have the foundation laid. We meet problems every day in our work, the solutions of which can only be attained by some extra thought and skill on our part. I want to touch upon the relation between scientific research and practice. It is common for dentists to say to an executive committee, "Now get some practical papers; we do not want any of these high flights of scientific research." Our society must realize that we should aim at a happy medium. We have not the time in our short lives to solve all the theoretical problems, no matter how important they may be. We can not study all the relations of comparative anatomy, no matter how interesting they may be. What are we doing as a body of men, associated together? Let us attack those problems which have an important bearing on our work, so that we can, year by year, take our cases with more confidence. For instance, less than ten years ago the etiology of all these conditions of malocclusion was largely an abstract proposition, but now under the guidance of some of our advanced thinkers who advise us to regulate teeth before they become irregular, it becomes a fundamental necessity that we should understand more of the etiology of these cases. If there is an etiological factor at work in a given case, the mere mechanical rearrangement of the teeth at six years of age will not necessarily prevent malocclusion. Let us not fly too high in our abstract researches, but let us put our minds to work to attack those problems which have an important practical bearing on our every-day work.

I do not believe those problems can be so well solved by individuals working alone. I make a plea to our members to do the best you can to co-operate with men who are studying some etiological factor, and aid them all you can with your experience.

In arranging the programme of this meeting we have had this idea in mind. For example, our president last year introduced the question of whether we should continue to use German silver arches and appliances, or whether we should rely upon the noble metals. We felt that the discussion of that paper at that time was very largely theoretical, and we searched for a gentleman who would take up this problem and make an investigation of it in a real scientific way, because we knew that if he could bring us any real facts about the influence of the various metals in the mouth, we could utilize them practically. We were fortunate enough in engaging a fine student, Dr. Clarence Grieves, to take up this study. He was obliged to have appliances which were used in the mouth. He tells me that even the year's work which he has put on it has not been sufficient to bring about absolutely certain data. I hope, after you have heard his paper to-morrow, if you feel as I do, that it is important in its practical bearing, that you will endeavor to persuade him to continue this work, and then give him a very full co-operation during the coming year.

Let us engage one mind in doing the actual work, and let each give every assistance in his power, and we may thus accomplish more than the mere listening to scientific lectures.

Dr. D. Willard Flint. Mr. President: A very interesting article on diet, its early history, with an account of its pioneers, is found in *Munsey's Magazine* for October and is well worth reading.

Dr. A. G. Danforth. Speaking with reference to fads, the development of malocclusion of children's teeth is no fad with the parents. It is a serious thing, and I find the parents are much more susceptible to teaching and instruction than the general practitioner who knows practically nothing about the work and has no particular interest in that direction, nor inclination to investigate.

Dr. Ottolengui was speaking with reference to men shooting too high. I think we have men, many of whom are capable of reaching out into those fields, which the general practitioner of orthodontia has no inclination or qualification for investigation. If they thus reach out it may enthuse to greater effort and throw light on matters connected with our work and generally better enable us to instruct our patients, who are the ones that will derive the benefits, and are anxious to be instructed. At times I have had parents referred to me who have been advised to have a tooth extracted for their child. I had a case yesterday where a young lady had a tooth extracted after having been so advised by three different dentists. The mother held up her hands when I showed her from diagrams what an injury had been done to the child. She thought it was the duty of the general practitioner to be informed on such matters. In the cases of children I find parents are anxious to be properly instructed, and will generally follow out such instructions carefully.

Dr. C. A. Hawley. There is nothing more I wish to say on the subject. I thank you for the discussion.

Some Suggestions on the Management of Cases of Malocclusion Associated with Mouth Breathing.

By Milton T. Watson, Detroit.

The management of cases of malocclusion associated with a pronounced lack of development in the nasal spaces has, in the past, caused me considerable anxiety. This was especially true in cases of Class II, Division I, and in cases of Class I, where the anterior teeth occupy a position quite similar to that in which they are found in Class II, Division I. The chief reason for this dissatisfaction has been because the patient again became a mouth breather as soon as the retaining appliances were adjusted. The two chief factors in this continued mouth breathing are "habit" and actual lack of nasal capacity. If these conditions are not corrected during the orthodontic treatment, the result will be a permanently lessened breathing capacity, and, of course, an unsatisfactory occlusion of the teeth.

The detail of treatment and retention, as I shall outline it, was planned with two purposes in mind. The first is to overcome the "habit" of mouth breathing so far as it may be a factor, and, the second, to bring about a development of the nasal capacity by compelling the nose to perform its normal function during the correction of malocclusion and the long period of retention which follows.

I was, long since, forced to the conclusion that it is only by the combined efforts of the rhinologist and orthodontist that even moderate success can be attained in dealing with patients whose internal face is underdeveloped to the extent of *materially lessening the nasal spaces,* as well as producing marked malocclusion of the teeth. Very often in these cases after the rhinologist has overcome everything of a pathological nature within his field, the nasal spaces are still insufficient for respiratory purposes; and at this point he is practically helpless—aside, possibly, from such benefit as may be gained by putting the patient on breathing exercises. It is the place, however, where our greatest usefulness begins, especially if the patient be young.

Advantages of Slow Treatment.

The orthodontic treatment should, of course, be taken up as early as possible, and in the usual way, using the ordinary appliances, together with the intermaxillary elastics, as outlined by Dr. Angle. You have no doubt all noticed that while patients of the type under discussion are wearing these intermaxillary elastics, they soon become able to breathe entirely through the nose, and, of course, this restored function will aid materially in bringing about a development of that organ. The widening of the dental arch, if that be necessary, and the mesio-distal shifting of the occlusion should, in my judgment, be carried on *very slowly.* The first advantage of this slow treatment is that a mild form of stimulation of the parts, which are influenced by orthodontic interference, is kept up for a much longer time than would be true if the treatment were carried on rapidly, as it might easily be. The tendency of this long continued stimulation to bring about a renewal of the latent developmental activity is certainly a direct blow at the very root of the evil, and is worthy, I believe, of our serious consideration. The very slow shifting of the mesio-distal occlusion is desirable, not simply because of the prolonged period of stimulation, but chiefly because the long continued wearing of the intermaxillary elastics, of just sufficient strength to gradually shift the occlusion, will keep the mouth closed, unless the patient intentionally resists it, which he will not do unless compelled to do so in order to breathe.

You will observe that I have suggested nothing new in the method of treatment; simply a change in regard to the length of time to be consumed, which I believe to be a matter of the utmost importance. The child whose nasal capacity—after rhinological treatment—is still below normal, will be able to breathe through the nose a part of the time, especially while in an upright position, and with the intermaxillary elastics in operation the period of normal respiration is naturally prolonged. We are thus gradually bringing about the normal function of the organ, which, I think we all agree, is essential to its proper development. During this period the child should be under frequent observation by the rhinologist, so that no pathological conditions may be allowed to interfere in any way with the rapid developmental changes which we have a right to expect.

If a full year is consumed in the correction of cases of this type, where the breathing capacity is markedly restricted, it will be found usually within that time that the child is breathing through his nose continuously, unless suffering from an acute irritation of the nasal mucous membrane. It is not to be inferred, however, that a "cure" has been established—and this applies with equal force to the underdeveloped nares and to the malocclusion of the teeth, for, notwithstanding the fact that sufficient development has taken place to allow nasal respiration, yet, when the recumbent position is assumed, the tendency of the increased blood flow to the parts is to lessen the nasal space, and if the mouth readily drops open, as it does while the ordinary retaining appliances are being worn, normal respiration at once ceases. It is for this reason especially that a mild degree of long continued intermaxillary force is suggested, for if this force be nicely gauged it will be easier for the child to breathe through the nose, even though its capacity is slightly restricted, than it will to open the mouth against the constant tendency of the elastics to close it. During the period of active treatment it is sometimes found desirable to have the child wear heavier elastics at night than during the day, in order to gently force normal respiration, and thus to a *limited degree* prevent the nasal engorgement which would otherwise obstruct the breathing. Whether this is necessary or not is a condition which can be determined only by the careful observation and co-operation of the mother or nurse. In the early treatment the lightest intermaxillary force which will induce closure of the mouth while the child is in an upright position is usually sufficient to move the teeth, though, if it proves not to be, it must be increased slightly—but do not allow yourself any anxiety because the teeth are moving slowly.

After the teeth have been in occlusion for a few weeks it will be found possible to keep them there with an intermaxillary force so slight that the patient is hardly conscious of any pressure at all when the mouth is *closed*. If you have been fortunate enough to bring about a fair nasal capacity during the slow progress of your treatment, you will find in a few months that during the day the teeth will require no further intermaxillary restraint, and that the patient will breathe normally. A very slight elastic pressure should be used at night, however, and for a twofold purpose—that of inducing the closure of the mouth during sleep, and, incidentally, to prevent any return of the teeth toward the old position. The wearing of very slight elastics at night can be continued just as long as it seems desirable to do so, though a time will finally come when they can be dispensed with altogether. It is, however, a matter of wisdom to leave the skeleton form of retaining appliance on the teeth, to afford them a mild degree of support for a considerable time after the elastics are discarded.

Depression of Incisors Opposed.

I am quite thoroughly convinced of the unwisdom, in cases where the upper incisors are elongated, of attempting to make corrections by depressing them in their sockets, though I recognize fully the desirability of doing so from a purely esthetic standpoint. The operation itself is one not especially difficult to perform, but I have yet to see a single case where anyone has really succeeded in establishing their permanent retention. The probability of establishing permanent retention after depressing the lower incisors in their sockets is very much greater, though even this is a questionable procedure; it is possible, however, to lower the occlusal plane or level of these teeth by tipping them forward in the line of the arch, which, of course, shortens them in their relation to the other teeth of this arch, and still allows for a permanent and satisfactory retention. In view of the opinions just expressed, it will, of course, be apparent to you that I believe it necessary to elongate the molars and bicuspids in making corrections in cases where the upper and lower incisors are in marked supra-occlusion. Sufficient elongation of the molars can be brought about through the application of the intermaxillary force which is used for the purpose of shifting the occlusion, but, as we all know from many sad experiences, the spur and plane plan of retention will not retain this condition. By bringing about the change in the mesio-distal relations slowly as I have suggested the tendency for the anchor teeth to return to their original occlusal level is not so marked anyway, and when the mesio-distal retention is brought about through the same influence which produced the correction, we can feel perfectly assured that the anchor teeth will not settle down into their sockets, but that the bicuspids will erupt, unaided, to a proper level, and when this has occurred the danger of an undue occlusal contact between the upper and lower incisors is at an end.

If our range of vision did not extend beyond the esthetic considerations involved in our work, it would, perhaps, seem like a needless expenditure of time to carry the orthodontic processes on so slowly, for great improvement was possible under rapid treatment; yet even this would not be entirely true, for with this plan the teeth upon which we depend for anchorage are in a much more stable condition at the end of the period of active treatment, thus being much better able to bear the strain of retention as well as lessening the possible necessity of secondary treatment. The real consideration, however, is not so much ease of retention as it is the elimination of some of the persistent etiological factors and the greater certainty of establishing a permanent occlusion.

Retention. The unsightly appearance of the regulating appliances makes it desirable for us to change them for others less cumbersome and conspicuous as soon as the heavy work of moving the teeth is accomplished. Here is where our trouble usually begins, for none of the old retaining appliances with which I am familiar have enabled us to prevent the anchor teeth, which have elongated under treatment, from settling down in their sockets again, thus allowing an undue occlusal contact between the upper and lower incisors. This was especially true in cases where the incisors were greatly elongated in the beginning, with the result that these teeth finally assume a more or less unsatisfactory position. Expressed otherwise, the situation is simply this: Our regulating appliances have enabled us to establish a satisfactory occlusion which we are unable to maintain with our retaining appliances. This condition of things forced me to the conclusion that retaining appliances for this class of cases must be designed so that they might operate upon the same principal as the regulating appliances, but modified in form to meet the requirements of a less severe strain, and to be in themselves less conspicuous. In the description of these appliances I shall not consider the needs of individual anterior teeth which may have been rotated or elongated, for they can be taken care of as they would under ordinary circumstances. The retention as I

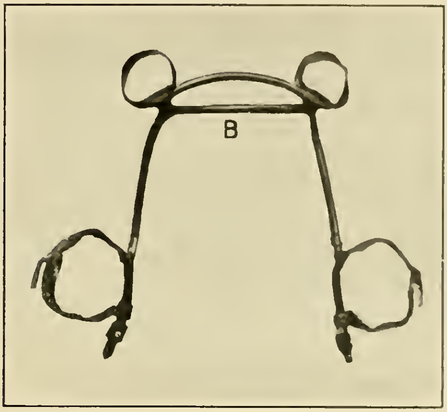

Fig. 1.

shall outline it will deal only with the chief characteristics of the case, which have hitherto caused me much trouble, but which now yield in a manner that has been satisfactory beyond my fondest hopes.

The illustrations which follow show very clearly the nature of the entire appliance, which is no more conspicuous than was the spur and plane or double spur plan of retention, and has the additional advantage of being very much more comfortable to wear and infinitely less liable to destruction from hard usage. These advantages, great as they are, sink to a position of comparative obscurity alongside of the importance of the influence we are thus enabled to exert over the breathing capacity and over certain habits which have always been direct obstacles in our path, as well as being of a nature so serious as to demand correction from a health standpoint. This scheme of retention need never exert a heavier strain on any tooth than just sufficient to antagonize its tendency to return, and with the spurs which most of us have been using to retain cases belonging to Class II there was always more or less undue strain on the anchor teeth during mastication, which kept these anchor teeth in a very unstable condition, while the plan now advocated allows them to become almost, if not quite, as firmly fixed during the period of retention as any of the other teeth.

A careful analysis of the direction of force as applied through the means of retention here shown will convince you, I think, that every direction of force tends only to antagonize the natural evil tendencies which we always encounter in the management of these cases. The six lower anterior teeth are retained as usual by banding the cuspids and uniting these bands with a wire soldered to their lingual surfaces, and running across the surface of the incisors at a point just above their lingual inclination. An arch is then bent to fit against the lingual surfaces of the bicuspids, and to rest against the bands already cemented on the cuspids, fitting snugly under the wire attached thereto, and bent so that it dips downward and rests in close proximity to the gums at the point marked B, Fig. 1, so that the second wire does not interfere with the proper cleansing of the teeth. The distal ends of this arch are firmly soldered to the molar clamp bands, fitted with the screws pointing distally, and a little hook for the attachment of the intermaxillary elastics is soldered to the buccal surface of these molar bands.

The upper appliance, Fig. 2 A, consists of an arch made from a fine gauge iridio-platinum wire (twenty per cent. iridium) to each side of which a hook of the same material is soldered for the attachment of the intermaxillary elastics. Clamp bands are fitted to the upper first molars, and sections of tubing into which the arch fits accurately are soldered to the buccal surfaces of these bands. In order that the pressure may be equally distributed this arch should be very accurately fitted, and a little collar soldered to it just in front of the buccal tubing on the anchor band. Instead of this little collar being attached to the arch you can close the distal end of the tube on the clamp band if you choose. The appliances thus described, together with the intermaxillary elastics, which should be tried out carefully until you have ascertained just how much force is required to maintain the occlusion, are all that is needed, except such attention as may be necessary for the proper retention of individual teeth. These appliances answer equally well for either the full division or subdivision of the first division of Class II, and occasionally in cases of Class I, where the upper incisors have been forced into protrusion, as we sometimes find them where a lower bicuspid on either side has failed to erupt, or possibly has erupted in lingual occlusion, and where the heavy pressure necessary to carry the lower anterior teeth forward would cause a distal displacement of the anchor teeth unless these teeth were reinforced by the use of intermaxillary elastics. The correction of such cases often demands a lingual movement of the upper incisors and a slight opening of the bite just as is necessary in cases of the first division of Class II.

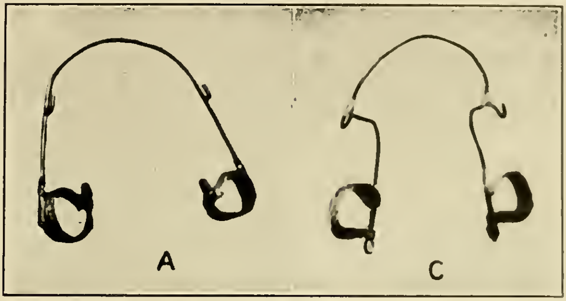

FIG. 2.

In cases of the first division of Class II, where considerable widening of the upper arch has been necessary, the upper retaining appliance can sometimes be made as shown in Fig. 2 C, in which the arch passing over the labial surfaces of the incisors and cuspids is bent sharply at right angles so that it passes between the cuspid and first bicuspid, where it is again bent so that it passes distally along the lingual surface of the bicuspid to the molar clamp band to which it is soldered. To this arch, at the point where it is bent to pass between the cuspid and bicuspid, a hook is soldered for the attachment of the elastic bands. This appliance is, of course, a little more difficult to construct than the simple wire arch passing around the outside of the teeth, but where the requirements of the case are such that an appliance of this kind is needed, it is the least cumbersome and most effective that I know. There are cases, of course, where the occlusal contact of the lower teeth is such that it might be difficult to pass this arch from the buccal to the lingual side, which would make it necessary to use some other means for maintaining the widened condition of the upper arch.

The great advantage of appliances of this sort with patients who happen to live at great distances, as many of our patients do, must be apparent at a glance, for its flexibility is so much greater than the spur and plane arrangement. It also possesses the advantage of enabling us to make most of the needed changes in the position of erupting teeth without going back to the regulating appliances.

There is another feature of some importaance which will especially appeal to those of you who favor removable appliances, namely, that after the teeth have been retained long enough so that no further intermaxillary restraint is required, the arch running around the labial and buccal surface of the upper teeth can be made of a heavier gauge of iridio-platinum wire, to lessen the danger of its becoming bent out of shape by handling, and the patient may be instructed to simply wear this arch at night for the slight influence it will have over the anterior teeth. In dealing with patients whose upper front teeth need a mild degree of retention for a very long period of time, this feature is not without advantage, for we all know how anxious our patients, especially young women, are to have retaining appliances removed, and with this arrangement, which after a certain time is worn only at night, they are quite content. The lower appliance is, of course, not removable, but it is less conspicuous anyway.

Intermaxillary Force in Retention.

In adjusting retaining appliances made after this plan, it is possible for us to do the work in several short appointments, which is very much easier for the patient than where one long appointment and a large amount of work was required, as was always the case when we had to adjust the spur and plane appliances. In my first experience with this plan of retention, which I began to use in a small way about three years ago, I had some fear that the elastic force might not work out satisfactorily as a means of retention, though I, of course, knew that it had in a way been used more or less in the days when cases of the first division of Class II were treated by extracting the first bicuspids and retracting the anterior teeth by the use of the head-gear; but I have now used it on a sufficient number of cases, and for a long enough period of time so that I feel certain that these fears were groundless.

In closing I wish to make it clear to you that I recognize fully that the plan I have suggested is simply a very slight modification in the detail of the regular treatment, with which you are all familiar, and for which we are indebted to Drs. Henry A. Baker and Edward H. Angle; and that the retention is also simply another modification of the principle of the Angle regulating appliances combined with the lingual arch on the lower teeth. This must make it quite clear to you that credit for originality is not sought.

Discussion of Paper by Dr. Watson.

Dr. Courie. Dr. Watson has made his paper so clear that it is hardly worth while elaborating it. I want to corroborate his ideas, and say that my experience in following that plan of treatment has been very satisfactory, and I am convinced the method is far superior to the methods commonly used—either the occlusal planes for jumping the bite, or strong elastics for jumping the bite quickly and retaining with occlusal spurs. I want to emphasize the point he makes of carrying the treatment along slowly in order to get the benefit of assistance in overcoming mouth-breathing, etc. I believe that in using this plan of treatment in Class II cases, the mandible assumes a forward position much more naturally and with apparently much less objection on the part of the muscles than where we attempt to hurry the movement, or move it immediately by the occlusal spur. I think the light elastics stimulate the muscles unconsciously, and you do not have the muscular resistance to the changed position of the mandible, especially at night. The occlusal spurs may be all right during the day time, but at night the patient bites on, and breaks or bends the appliances, often loosening the teeth in the process, and allowing the recession of the mandible to its original position, as already pointed out by Dr. Angle.

I believe that with the treatment outlined by Dr. Watson we get or retain a much greater forward movement of the mandible than with the methods previously followed.

I can not agree with the essayist on one point, namely, the idea that all of these cases must be treated in the way he has suggested—especially those cases in which the incisors are really in supra-occlusion. Simply because we have failed to keep the incisors in their normal position is no reason why we should adopt this method. We should put the incisors in normal position and retain them there. Do not stop trying to arrange some device for keeping them right. If you bring the molars and bicuspids down to their plane (the incisor), you have the whole dental apparatus in abnormal relation to the face. The result might be as objectionable as the original protrusion of the incisors.

The appliances are admirable for the conditions shown. Of course, that is a minor consideration, as the special design of the retainer can be modified to suit any given case.

Dr. Danforth. I saw one of Dr. Watson's cases in Detroit last year, and I would like to refer to the case of mine of a young man seventeen years of age, who suffered from tuberculosis of the hip joint when a small boy. The physician did not wish any inflammation created at all. The case was a marked form of Class II, first division. Light elastics were used for fifteen months. Heavy elastics were not used in any stage of the operation. Spurs and planes were used for six months. They failed to hold the teeth. I again resorted to the light elastics, and allowed the patient to wear them eight months longer. They were taken off eight months ago. The teeth are in beautiful occlusion, and everything in good condition. The physician had this patient under close observation all the time, to note whether any inflammation might arise. None whatever occurred during the whole period of treatment.

Dr. Kemple. It seems to me the underlying thought of most vital importance is the one of gentle stimulus to bring about a normal development of the parts concerned. In other words, the idea most prominent in Dr. Watson's paper is to assist nature in the development of the parts, rather than to move the teeth rapidly by mechanical interference. That, in reality, I believe is the function of the orthodontist. It is that one thought that has made prominent the idea of early treatment—treatment at a time when you can, by gentle stimulus, bring about normal development, not only of the dental arches but of the underlying structures, securing a full, normal development of the nasal passages, and aiding the patient, particularly at night, in keeping the mouth closed. To me it seems that that part of the paper is of the greatest importance.

Dr. Rogers. Dr. Watson's and my own paper overlap in one or two ideas. No doubt the discussion of his paper can be taken up in fuller detail when the discussion of my paper takes place.

(Discussion of Dr. Watson's paper postponed to be taken up in connection with Dr. Rogers' paper.)

A Consideration of Infra-occlusion.

By Dr. Alfred P. Rogers, Boston, Mass.

When one or more teeth fail to reach their proper position in relation with the occlusal plane, they are said to be in infra-occlusion. This condition may be confined to the anterior portions of the upper arch, as we see so frequently in those cases which are sometimes termed "the open bite," or it may be found on the lateral halves of the dental arches, involving the bicuspids and molars of either the upper or lower arches, or both. There are also cases on record showing an infra-occlusion of the entire upper and lower dentures.

There are few problems, if any, of greater moment or greater seriousness to the orthodontist, than the treatment and retention of infra-occlusion, alone or in combination with other mal-developments of the dental arches. It may be associated with almost any condition, but is most serious when found in combination with supra-occlusion. Then it presents a deformity of the most serious character. It is for the consideration of those cases where a number of teeth are involved, rather than of those in which only one or two teeth play a part, that I ask your attention.

Etiological Factors.

In making observations regarding the etiology of infra-occlusion, I have been unable to find anything that would suggest to me that the condition may be of pre-natal origin, except in those few cases where undue lack of development of the pre-maxillæ makes it impossible for the

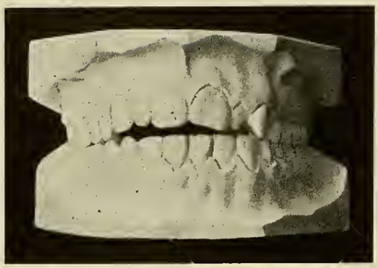

FIG. 1.

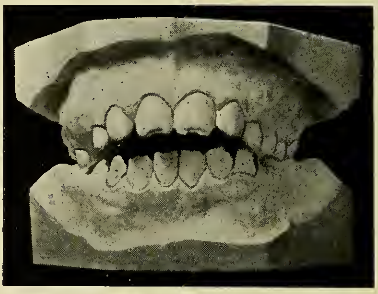

FIG. 2.

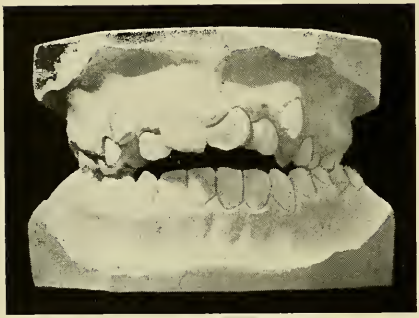

FIG. 3.

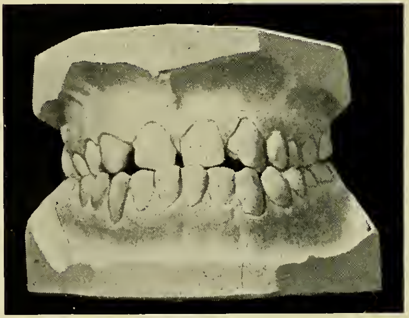

FIG. 4.

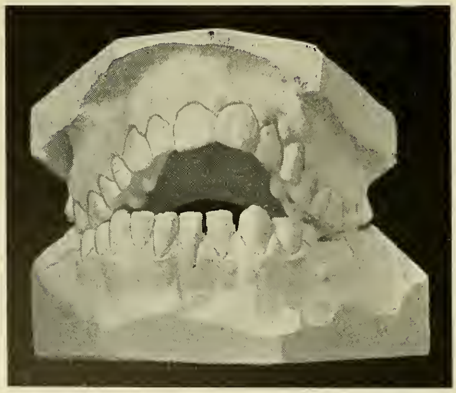

FIG. 5.

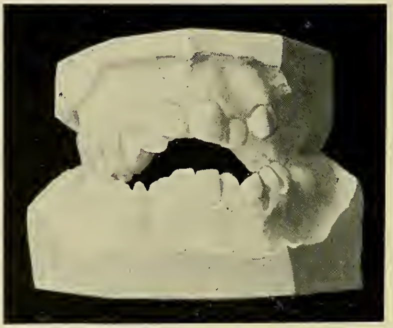

FIG. 6.

teeth to erupt sufficiently far to occupy their proper position on the occlusal plane. In many cases the causes seem very generally identical with those which we are convinced produce other forms of mal-occlusion; for instance, those which seem traceable to the inability of the anterior teeth to erupt, due to the lack of development of the facial bones. There are other classes which seem to be directly due to habits in connection with the thumb, lip or tongue considered as the exciting cause. There are other cases in which every known causative factor of mal-occlusion may be well imagined to have played a part. My endeavor shall be to present to you as large a variety of infra-occlusion as my collection of models will allow. Fig. 1, a girl of thirteen, is a simple case, showing what the tongue may accomplish in the establishment of infra-occlusion. There was no distal relationship in these arches before the habit began, and I learn from the history of the case that the habit was not in operation until after the eruption of the permanent teeth. The habit is a simple one, but difficult to control. Merely the pressing of the tongue against the lingual and cutting surfaces of the upper incisors. This action, you will note, if you try it for yourselves, has a tendency to throw the lower arch distal to normal. The lower arch in this case is of normal shape and size, but the upper is slightly narrow in the molar and bicuspid regions.

Another form of infra-occlusion, and one which is very prevalent, is that which is stimulated, encouraged and sometimes caused by the habit of thumb-sucking. Fig. 2 shows a case of this kind in a boy about nine years of age. The habit was persisted in for many years, the father assuring me that it was present from infancy, and continued until the boy was nine years of age. After that the habit of thumb-sucking was discontinued, but the habit of tongue-sucking was substituted.

Fig. 3. This case represents infra-occlusion in a girl of fourteen. It is due solely, as far as any history of the case is concerned, to a lack of development of the maxilla. No one in connection with the family remembers that the girl has had a habit of thumb, lip or tongue-sucking. It seems entirely due to an unfortunate contact of the various teeth in their efforts to erupt where the bony development was not great enough to allow them to assume their proper positions.

Fig. 4. This type of infra-occlusion is due to the lack of development of the pre-maxillæ. It was surprising to me to find how thin and insufficient was the osseous development in this case. The laterals were entirely absent, and the insufficiency of the bony tissue was so great that the incisors were not even firmly held in their sockets. This case seems to reflect a strong possibility of pre-natal origin.

Fig. 5. This extreme type of mal-occlusion, in a nineteen year old

boy, has had several factors in its development. I have been able to trace habits with thumb and tongue, and a childhood environment, that would be expected to produce severe mal-occlusion without the help of these pernicious habits. The thoughtless dentist had his share also, because he extracted the first and second molars on the lower right side. This case is extremely difficult of treatment, and even more difficult of retention, and I hope it will serve to warn every thoughtless dentist that he is lacking in his duty and ignoring his privileges if he allows to develop among his child patients any such condition as illustrated here.

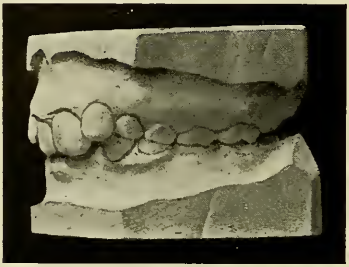

FIG. 7.

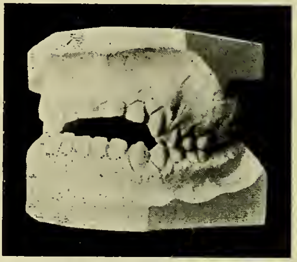

FIG. 8.

Fig. 6 is a girl fourteen years of age; the condition is again due to an unfortunate combination of all the causes that produce mal-occlusion; but although the incisors have not reached their full position upon the occlusal plane, the molars have advanced beyond their positions and have assumed the state of supra-occlusion. There is also a marked hypertrophy of the tissues in the molar region. This, too, has a history of neglect and procrastination, and a record of constant mouth-breathing.

Fig. 7. This class of infra-occlusion is confined to the molar region, and is one which I shall speak about more fully when I come to the treatment of these cases.

Fig. 8. This is the result of a habit of sucking the thumb, and later the tongue, complicated by extraction of the lower right molar; there is also a history of adenoids and enlarged tonsils, and, of course, mouth-breathing.

During that period of transition, between the loss of the deciduous and the complete eruption of the permanent teeth, there is a gradual growth of the face in length, breadth and depth. The length is influenced very largely by the increased vertical development of the teeth and their processes. It is during this period, in normal cases, that a new and correct occlusal plane is developed; but in those cases where abnormal influences are introduced there is a destruction of occlusal balance frequently resulting in mal-development of the occlusal plane. If the incisors are allowed to develop unhampered, they reach their correct occlusal altitude, but when influenced by retarded development in the pre-maxillæ, from whatever cause, they are prevented from reaching their typical positions. The same is true in the molar and bicuspid region.

Occlusal Plane.

As we have seen that infra-occlusion consists of the failure of one tooth, or any number of teeth, to reach their proper occlusal plane, it is very clear that we must endeavor to arrive at some method whereby we may know where the occlusal plane shall be and whether or not we are dealing with infra-occlusion or supra-occlusion, or a combination of both. I believe it to be quite generally admitted that there are many types of occlusion, as there are many types of faces—yet each type must have certain distinctive characteristics that may be classed as normal, just as in the mouth we look for the correct mesio-distal position of the arches and the proper relationship between the inclined planes; but aside from these characteristics, occlusion must vary, and we find various types whose distinctive features classify them. These features consist of the shape and length of the inclined planes, the inclinations of the roots and the shape of the occlusal plane, etc. It is, therefore, quite essential that the orthodontist should classify, that he may be able to recognize types and thus aid himself in dealing with these cases of infra-occlusion. The occlusal plane may be either a pronounced curve, a slight curve, or even approximating a straight line, according to the type. I was much pleased a short time ago to be shown a compilation of the types of teeth and of occlusion being prepared by Dr. A. W. Crosby. The idea is one which will exactly suit our purpose in our studies, and will be of great value to us in our treatment of those cases where it is necessary for us to establish a new and correct occlusal plane. For instance, taking that section upon occlusion, we are told that in the bilious temperament we have a long over-bite and a dip of the arch in the compensating curve, with strong interlocking of the cusps, indicating that the inclines on these teeth are steep and that the cutting edges are sharp. Now, in the sanguineous type the over-bite is short and the compensating curve is rather flat. In the nervous temperament we again have the long over-bite and the marked compensating curve. In the lymphatic we have the short over-bite with very little depth to the compensating curve. From this we can readily see that the occlusal plane indicates to us the type, and if we understand the type we will understand how best to establish the occlusal relations. The one point about all this that is of most practical value in the treatment of infra-occlusion is the length of over-bite.

Treatment. In making our study of the treatment of infra-occlusion, let us begin with the correction of that class in which we recognize infra-occlusion in the molar region, which is very often found in Class 2, Division 2, and sometimes in Class 1. A very interesting and valuable case of this kind, showing infra-occlusion in both upper and lower lateral halves, has been treated by Dr. Frederick G. Kemple. A description by Dr. H. A. Pullen may be found on page 627, *Text Book* by Johnson. Upon first observation one is very apt to feel that there is a supra-occlusion of the incisors, Figs. 7 and 9, but in cases of those young in years it does not seem reasonable that the lower or upper incisors should erupt so rapidly and take their positions so far beyond their proper occlusal plane. Again, a fact that makes me believe that they do not erupt further than their natural positions, is that although the central incisors erupt first, they do not continue their course, but are soon caught up with by the laterals and occupy with them a common plane. It has been quite generally supposed that in Division 2 of Class 2 the incisors are in supra-occlusion, and that in treatment they should be depressed in order to establish the proper occlusal relations; but it has occurred to me that this plan is not the correct one, for it seemed that these incisors which were apparently in supra-occlusion had in reality only reached their proper positions and by reason of the infra-occlusion of the molars, usually the lower, these incisors were allowed to glide past each other, with the result so familiar to us all, as shown in Fig. 7.* In these cases the simplest and most effective treatment is to re-establish the shape and size of the arches, then follow this by the application of a retaining device similar to the one shown in Fig. 10. This, of course, applies more perfectly to those cases which are brought to us early, say between the ages of six and eleven. The biting surface of this plane is made to occupy a distance

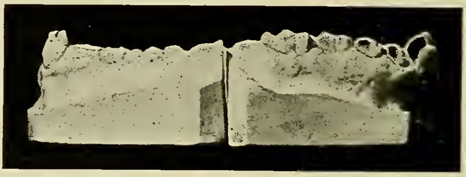

Fig. 9.

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*I wish here to refer the reader to an article written by Dr. R. Ottolengui, published in the "Items of Interest" in July, 1908, especially to the section on the occlusal plane, p. 504.

from the cutting edge of the incisors equal to the length of the over-bite of the special type to which the case belongs. For instance, if a nervous type, a long over-bite, if a sanguineous type, a short over-bite, etc. The application of the lower retainer is made in such a way that there is ample opportunity for individual tooth movement, so that the erupting bicuspids and cuspids, as well as the lower molars, may easily find their way into their proper occlusal relations. Following out this treatment, I have found it unnecessary in these cases to use the inter-maxillary elastics unless one wishes to bring the lower molars more quickly into occlusion with the upper. Fig. 11 shows the lack of buccal occlusion, with the retainers in place, and the jaw closed. Delicate elastics may be made to engage hooks placed on the buccal surfaces of the molar bands. The ease and comfort with which these cases have been treated has been a source of the utmost satisfaction. Should the bicuspids erupt in torsal-occlusion, they can be brought into their proper position by the use of ligatures and the lingual arch.

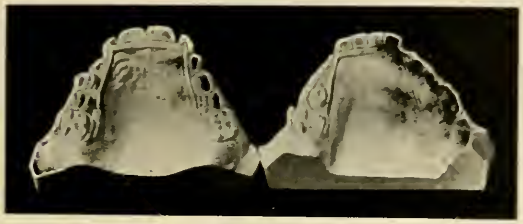

FIG. 10.

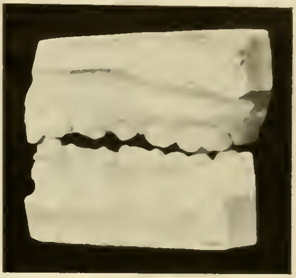

FIG. 11.

Coming to the treatment of those cases where we have infra-occlusion of the anterior teeth, particularly in the upper arch, it is a matter of much greater seriousness, and although it is a fact that tooth movement in this direction is sometimes easy, yet there are many dangers that must be guarded against, such as too rapid movement; too great an intermittent pressure; the danger of instability of the molar anchorage; the elevation of the lower cuspids and incisors, where such is not indicated, all these usually being due to an unequal balance of force. In the application of appliances for the correction of these conditions, it has been my experience that the lighter the expansion arch the more effective is the work; especially is this true in older cases where expansion of the arch in the molar region is not indicated. I have found in these cases that the use of the 18 gauge expansion arch has given some very satisfactory results. Figs. 12 and 13 have been produced with a view to showing you the form of appliance which is found most effective. You will notice the spurs that are soldered on the under surface of the lower arch, and also on the upper surface of the upper arch. It will be observed that these are slightly ball shaped. They are made from clasp metal wire, 22 gauge, and after being soldered to the arch and cut a little longer than the proper length, the ends are held over the flame until they are melted into a ball shape, which you see in the illustration. This gives an easily made appliance, and no filing is necessary before the polishing is done. The location of these spurs, particularly those of the lower arch, is made according to the requirements of the case under treatment. If we have a case of Class 2 complicated with infra-occlusion, then we are likely to place our spurs on the lower arch somewhat distal to the lower cuspids. If it happens to be Class 3, we would desire them mesial to the lower cuspids.

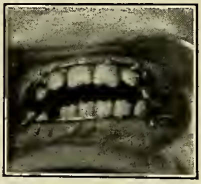

Fig. 12.

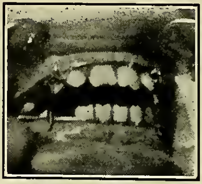

Fig. 13.

Perhaps a word regarding the clamp bands may be advisable. For the sake of reinforcing the molars to which they are attached, I find it a good plan to solder a spur on the mesial aspect of the band, allowing it to engage the morsal surface of the second bicuspid or pre-molar. With the 18 gauge arch and the use of the raw silk traction cord No. 1, there is little strain put upon the molars at any time. These ligatures have the happy faculty of marked shrinkage upon being wet, which causes a very gradual, very steady correction of these cases. Few teeth at a time should be ligated. In some cases it is advisable to bring the strain upon two teeth only, while in others when the movement appears easy, some four or six teeth may be ligated. It is not always that I find it necessary to put into use the vertical or "up and down" elastics, as they are termed by Dr. H. A. Baker, but in cases where they are used it is advisable to use great care that we have stationary anchorage of the lower arch, unless it is desirable to change the position of these teeth also. There is one important feature regarding the correction of infra-occlusion which must be clearly stated, and that is that *in all cases the best results are obtained if harmony in the size and shape of the arches is first established.*

Retention. It may be safely said that with few exceptions there is no class of mal-occlusion which is more difficult of retention than those which are complicated by infra-occlusion, especially when treatment is delayed until the permanent teeth have all erupted. It is quite a different matter to treat and retain a case where all the teeth have not erupted, because by the addition of new bony material deposited about the newly erupted teeth, the corrected deformity is brought into more natural relationship and reinforced, so that a long period of retention is usually unnecessary if any existing habit which may have previously influenced the condition has been broken. There have been many means employed for the retention of infra-occlusion, in that class of cases distinguished by the term "Open-bite."

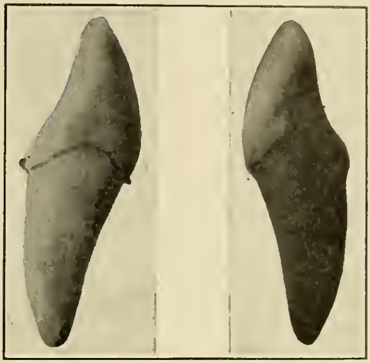

FIG. 14.

A retainer that I have found very effective in one class of my cases is constructed on the idea illustrated in Fig. 14, which is a picture of the central incisors. You will notice that at the junction of the enamel and cementum there is a slight depression both lingually and labially. There are some cases in which these points may be taken advantage of, and a retainer constructed similar to the one shown in Figs. 15 and 16, with molar bands and lingual wire, and labial arch from cuspid to cuspid. It has been my experience that in these cases when the cuspids and centrals are firmly held in position, the laterals remain also without any special pressure being brought to bear upon them. After the retainer has been placed in position, the points A and B are burnished firmly against the labial surface of the tooth at a point shown in the last figure. At the same time the two spurs on the lingual side are securely burnished against the point on the lingual surfaces of the teeth. This, I believe, in those cases where the central incisors will permit, is one of the best forms of retention. The lingual arch must be constructed of very stiff clasp metal wire of 18 gauge, with a spur engaging the grinding surface of the second bicuspid, as is the case during treatment. Another form which I have used to advantage is one in which there is an absence of the labial cuspid to cuspid wire, its function being performed by two bands upon the central incisors with lugs engaging the laterals and taking advantage of the same points on the laterals explained, regarding the centrals, in the last retainer. The lower retainers are constructed upon the same general plan, but I think it usually advisable to band all six of the anterior teeth and allow the teeth to be supported by the use of spurs over the lingual arch. Especially is this true when the up and down elastics are to be used at night. The subject of retention of these cases is one that will require a great deal of study, and contributions from many men before it is finally solved, because there are so many variations and the form of retention depends so largely upon the age at which the correction of the mal-occlusion has been undertaken and that frequently present factor of unbroken habit. It does not seem necessary for me to make any particular reference to the retention of Class II, Division II, for little or no retention is necessary after the eruption of the permanent teeth. What I have given you is simply what has been found in my own experience to be trustworthy and yet I feel like saying that anyone of these methods may fail if its application is not exactly what is indicated.

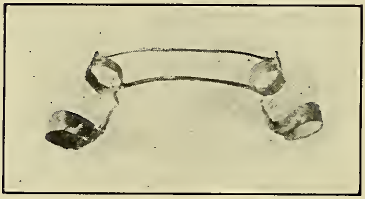

FIG. 15.

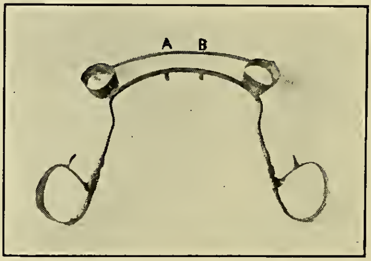

FIG. 16.

Correction of Habits.

Close upon the consideration of retention of infra-occlusion, I would bring to your notice one of the most serious offices that the orthodontist has in the correction of those cases which we are convinced are influenced or caused by habit. It is the duty of permanently breaking these habits in young children, for failure here renders all skill in treatment and retention of no avail. It is true that in the very young methods of procedure, such as the use of the aluminum mit, are quite effective in one form of habit, but very often older children are brought to us who are seriously addicted to these habits, and as every intelligent orthodontist knows, so long as the habit remains unbroken and completely so, it is useless to waste time and energy in an endeavor at correction. It has been my privilege to have one or two interesting cases of this kind, and the method used may be of value to someone else. Of course, it is possible in these older children to tie the hands and to use mits, etc., but I think it quite true that these methods are but indifferently successful, besides being a humiliation to the child, and constant hardship to the mother or nurse, so that their application is frequently forgotten, which adds to its inefficacy; again, from a psychological standpoint, the breaking of habit by force or by punishment has not the advantage to the child that we desire. Therefore, in children of older years it is my custom to endeavor to teach them how they can by mental control overcome and forever abandon that which is destroying the contour of their faces and making impossible the normal occlusion of their teeth. Being essentially the children's doctor, it is taken for granted that each employs a successful method in dealing with children; as a class there is no one who deals more gently or more kindly with their patients than the American orthodontist. It is as essential to his success to gain the love and trust of these little ones, as it is to have the ability to make and adjust beautiful and accurate appliances. Therefore, if he has gained their sincere trust, he has placed himself in a position to begin his work in the breaking of habit, but possibly one illustration of a recently successful case may explain this method better than can be done in any other way.

A mother brought to me her little girl, eight years of age, who was suffering from infra-occlusion. She had had the persistent habit of thumb-sucking from early childhood. Nothing that the mother could do seemed of the least avail. An appointment was made for the child when I knew there would be plenty of time to talk with her. The mother told her that one of the first things that would be required of her would be to stop sucking her thumb. In answer to this, she very curtly sent word to me that she would not stop for me nor anyone else, and that she sucked her thumb because she wanted to. It was now quite clear that my first duty was to gain the child's confidence, and when I had got near enough and found that she had grown somewhat interested and trustful, the various evils of the habit were pointed out to her, and it was explained to her how she could never look normal or like other girls if she persisted in it. I explained to her that it would be useless to try to correct her teeth unless she too would do her part. Finally, by degrees, she began to realize the seriousness of it all, and admitted at last that she did really want to stop. Here, of course, is the point. *We must create a desire on the part of these children and stimulate that desire until it grows into a determination to overcome that which is harming them.* It was then pointed out to her that she must work from within, teaching her about her will and what the will would accomplish, showing her how in many ways she willed to do things and usually did them, pointing out how she could direct her will to break any habit she wished. Before she left, there came the earnest promise that she would try very strongly and determinedly, and she did. A week later she came again and very confidently whispered in my ear that she had had her thumb in her mouth but once and that she was never going to do it again. Later, I learned that that once was after she had been very much exhausted from a day of over-play. Such a method, I believe, is the most successful and the most useful, because who can estimate its true value upon the young mind just learning how to care for itself?

Discussion of Papers of Drs. Watson and Rogers.

Dr. Pullen.

The very interesting chapter of infra-occlusion which Dr. Rogers has read to us to-day contains, to use the popular phrase at this meeting, "much food for thought and reflection." It contains much food for thought, because it deals with the etiology, diagnosis and treatment of a form of mal-occlusion which is so uncommon and diverse in its characteristics that no one man's experience can include them all, and which present in every class of mal-occlusion with such extremes of attendant difficulties in treatment as to baffle the most expert. Therefore it is that after a due consideration of all the known varieties, as presented to us in the essay, we still have food for reflection, which food it is to be hoped, will, if scientifically digested, be so assimilated as to most particularly benefit each one of us.

Infra-occlusion is best described by the designation of the region in which it is observed, as infra-occlusion of incisors, incisors and cuspids, cuspids and bicuspids, bicuspids and molars, etc. It has occurred to me that we have not been careful enough in our observations to note some of the characteristics which enter into these conditions. For example, in infra-occlusion of the incisors, cuspids and bicuspids, and oftentimes when it extends into the molar region, we have a condition in which both upper and lower dental arches take a part in their variation from the normal occlusal plane; this latter being, so to speak, in a line drawn in space between the incisal edges of the upper and lower incisors. Especially in this condition may be noted the greater length of the lower third of the face, and the partial or complete obliteration of the angle formed by the ramus and body of the mandible in many cases. This class of infra-occlusion is usually the extreme mouth-breather, exhibiting to the greatest degree the effects of the habit, and the abnormal tension of the muscles.

Treatment of this condition is theoretically correct, in which the occlusal plane lies, we will say, half way between the upper and lower incisors, which would imply that the teeth of both upper and lower arches be moved equally toward the imaginary line of the occlusal plane, involving such application of dynamics and such control of resistance—to say nothing of retention—as has not been described by anyone attempting this treatment.

After the age of six or seven years it is my belief that any change in the obtuseness of the angle of the mandible is well nigh impossible to accomplish through present known methods of operating. However, I do believe that if this condition is treated before the age of six or seven years that it may possibly be completely overcome, especially with the use of the head-gear and chin-cap assiduously worn.

Again, I would call your attention to the over-development, or supra-occlusion, of the molars, involving infra-occlusion of the incisors, cuspids and bicuspids. Here we have another combination of evils which has been mentioned by the essayist, in the treatment of which conditions our utmost skill is demanded.

The essayist has also pointed out to us that in the etiological factors involved, the habits of thumb, lip and tongue-sucking are oftentimes concurrent evils, adding still greater difficulties to the treatment, and for which the suggestions he has made for control of the patient are very pertinent.

A new thought has been suggested to me in this paper, and that is the possibility of determination of the occlusal plane by a diagnosis, as it were, from the length of cusps, the over-bite, and the indicated compensating curve. In order to do this we must go back to the studies of Bonwill, on the laws of articulation, which are as essential to the science of orthodontia as the laws of occlusion.

Dr. Ottolengui. I think Dr. Rogers was very right in saying that these two papers lap. For example, I think that all Dr. Watson said this morning about making haste slowly is as applicable in infra-occlusion as in the cases to which Dr. Watson alluded. I am at the present time, as in the past, still of the opinion that the so-called supra-occlusion of the incisors in Class II is more apparent than real. I believe the super-imposed (Fig 11) casts of Dr. Rogers, where he moved the lower cast forward to fit the inclined plane back of the central incisors, is a truer picture of the real facts than you get when you accept the idea of the supra-occlusion of the incisors. I have no doubt Dr. Rogers gets the results he describes with very young patients. Dr. Barnes's remarks this morning about getting rid of these difficulties while the patient is young are pertinent; but we are still obliged to conduct some cases where the patient is eleven or twelve years of age, or older.

I wish to report to you a method of treatment in connection with Dr. Watson's suggestions, which I have used with satisfaction in the last year and a half. Dr. Watson spoke of the very unsatisfactory results obtained after elevating the lower molar through traction of intermaxillary force, of finding it settle back later on. If you start with the preconceived idea that you wish the molars and bicuspids elevated you might do, during treatment, what I have done only during retention, and so get a better result. This is the line of procedure: Band both bicuspids in the lower arch, as soon as they have been brought into arch alignment; have a lug or resting place on the buccal surface of each of the Magill bands. Solder to the buccal surface of the molar band a wire, extending it forward as far as a little in front of the first bicuspid, and resting it under the lugs. You may thus accomplish two things: elevate the molars less rapidly, and at the same time elevate the two bicuspids with this force. The hook for the elastic, however, must be at the mesio-buccal angle of the molar. You go slowly, but get a more stable anchorage, and do something toward the elevation of both the bicuspids and the molar, and thus help to cure the infra-occlusion on that side. In two presumably completed cases last spring I found what is sometimes called an "open-bite" in the molar and bicuspid region, and I was disgusted to think I had not done any better. They were retained with devices made as above described and use of the intermaxillary elastics continued, and both patients came back with the teeth in full vertical occlusion. You are safer in this type of mal-occlusion to utilize the intermaxillary elastics during retention. Their effect is self-limiting, and you are not apt to overdo the work. In my most successful case of infra-occlusion of incisors and cuspids the treatment covered a period of three winters, with summer resting periods between; the up and down elastics were used continuously. At present the child simply wears them at night, and I know that no harm has resulted.

I believe in these cases, more than in any others, we must wholly depend upon a more or less continuous force, and with as fixed appliances as possible.

If we are to make scientific progress at all the time has arrived when we must study for ourselves this problem of infra-occlusion. It causes me much perplexity. It is comprehensible to my limited brain cells that in the building of the human structure, as in any other, there may be a normal nourishment of the parts of the body, with the possible exception of one part. In other words, I understand how one part might not receive sufficient nourishment, because of a lack of material or of vital energy to utilize the material. I can understand a lack of development locally, but it is difficult to comprehend, in the absence of true disease, the overgrowth of a single part. It is, therefore, easier to believe that Class II is an infra-occlusion of the molars and bicuspids, and that the open-bite cases are caused by a lack of development of the premaxillaries than it is to believe that the incisal region of the lower jaw in one case, or the buccal processes in the other are overgrown, overdeveloped, etc. We need to know much more than we do of bone development.

Dr. Bogue. Dr. Rogers has not only gratified, but instructed us, but I have found some difficulty in trying to understand one or two of his terms. One is "infra-occlusion." There seems to me to be a contradiction of terms there. He said at one point "characterized by open-bite."

The next question I would ask is, did he carefully calculate, in the models shown on the screen, the width at which he wished to spread laterally the molars? There is a definite calculation open to us, and when the molars occupy those lateral positions relative to each other which they ought, in many cases which I have seen, this open-bite becomes very nearly a close bite.

Dr. Rogers. I do not think I can answer that question for you any better than you can answer it yourself. Infra-occlusion means that the teeth have failed to reach their proper plane. That plane is imaginary until we have established the proper type; then, of course, we have the proper plane established.

No doubt we could improve our nomenclature very much, and as our work is still in its infancy we may hope Dr. Bogue will give us a better term very soon.

As to the width of molars, I was influenced by Dr. Hawley's scheme of charts. I took those to be as nearly accurate for the type of case as necessary.

Dr. Bogue. I wish to make my earnest thanks to Dr. Rogers for that explanation. I am not trying to cavil, but am in earnest. We should all understand as valuable a point as that, and all it means.

Another question, which has a bearing on his paper, as well as Dr. Watson's: Does Dr. Rogers regard the retention of the lower teeth as something rather more important than the retention of the upper? As nature erupts the lower teeth first, and the upper teeth are guided into their normal positions (if the teeth are normal) by means of the cusps and inclined planes thereupon, does Dr. Rogers take pains that the lower planes shall be retained especially, in preference, if necessary, to the upper?

Dr. Rogers. If the lower arch has been broadened, it must be held. If no infra-occlusion exists in the lower arch, I should not regard it necessary to retain it, *i. e.,* if the infra-occlusion is found solely in the upper arch.

Dr. M. H. Cryer. I want to say to you that I am carried away with the active work of this society. I expected to discuss a paper yesterday and then enjoy the sights about the city with my wife. But I have asked her to go alone and allow me to come here and listen. You are all so energetic that it does my heart good.

Dr. Ottolengui strikes a key-note—not *the,* but *a* key-note—when he speaks of the bone nourishment and development. The first principle of good surgery of the mouth is that you must know your anatomy—you must know the physiology of those parts. You must also know the pathology. You younger men should use some of the energy that you do use in the correction of irregularities, in those two branches, physiology and pathology. At some future time I hope I will be able to speak further on the physiology and pathology of these conditions which have been illustrated on the screen.

Speaking of Fig. 2 shown by Dr. Rogers: he spoke of the child as a thumb-sucker. According to the intimation Dr. Ottolengui has given us, we should look further than the thumb and the position of the teeth—we should look at the character of the teeth. They are not typical incisors. They are round and more oval-shaped, and the points appear to have been lost, as though the child had some eruptive disease during the development of the enamel of the teeth. There was a lack of proper nourishment at that time perhaps. I presume that while that was going on there was a lack of nourishment of the alveolar process and perhaps of the true maxilla, and if so, the eruptive force of the teeth, whatever that may be—did not have the power to push those teeth down into their normal positions.

I think it is well, as Dr. Ottolengui suggests, for us to study those points a little more closely than we do.

Dr. Hawley. Two points occur to me that may be of value in regard to thumb-sucking. There is one case I had in my own practice this year that was typical. The patient was a girl ten years of age. So far as family interference was concerned, every possible effort was made to break up the habit, namely, mittens, plasters, etc., were used, but the child would remove these things during sleep. Upon commencing treatment (a Class II case) I placed on the upper right central incisor a plane band and upon the lingual surface of that band soldered a wire spur, extending one-sixteenth of an inch below the cutting edge of the teeth. On the lower right central incisor a similar band and short piece of wire was placed. I had a doubt as to whether the spurs would not cut the tongue, or interfere with eating. To my surprise and gratification the mother said the child ceased to suck her thumb, and the appliances did not interfere with the eating.

Another is a case of Class II, with open-bite, which I treated. The child was eleven years of age. The cuspids were not erupted, and the upper centrals and laterals were in infra-occlusion. Treatment lasted thirteen months, with light elastics. The width of the upper arch was very nearly normal, and little expansion was necessary. The upper section of the maxilla seemed to move down bodily into its place—slowly, but without extruding the teeth. The first retention I used was that of a stiff arch, fitting tightly in buccal tubes on molars, and sprung upward to engage spurs on the incisor bands. I used a seventeen gauge platinized gold arch. In six weeks the teeth commenced to move back. I removed the arch, changed the spurs on the lower molars, etc., banded the centrals and laterals, with a hook over each lateral, slanting slightly backward. The lower teeth were banded and fastened together. I used a very light elastic, somewhat on the plan Dr. Watson has suggested. While very light, it has retained the case completely and with great comfort.

I had the pleasure last spring of seeing some of Dr. Watson's cases in his office, and I can assure you that the treatment was ideal and the retention successful. The influence of this loose arch on the anterior teeth is something which has been impressed on my mind in the use of the removable retainer. I have been surprised at the accuracy and the ease with which a labial bow, resting against the teeth, with a lingual plate, will hold teeth that were rotated. It seems that just the constant touch of the arch or bow will keep them in position even better than bands. There is something in the constant contact of the arch, bent just to the arch of the teeth, that is of much advantage.

Dr. Kemple. I would like to know what is the proportion of cases of the type being considered, wherein Dr. Rogers has found that the close attachment of the frenum has been a factor in preventing the eruption of the upper incisors or the development of the pre-maxilla?

Dr. Rogers. I never made any special note of that point. You do not mean the abnormal frenum, do you?

Dr. Kemple. It would be a short frenum, and an active, nervous upper lip.

Dr. Rogers. It is a new idea to me. I have not noticed it closely enough to tell you anything about the proportion of cases wherein it may occur.

Dr. Young. In regard to the bite-plane which Dr. Rogers showed on the screen, attached to bands on the central incisors. As I understood the slides, his was a solid bite-plane. If these are worn for any length of time the tissues directly under them and around the central incisors become much hypertrophied and inflamed. I have overcome this by using a skeleton bite-plane, made from say a nineteen gauge iridio-platinum wire. By using this gauge of wire, and bending it properly, you can overcome the difficulty I have mentioned.

Dr. Watson. I think there is nothing further I care to say on the paper, with the exception of answering the question of Dr. Lourie. In his opinion, because we have failed in times past to retain incisors depressed in their sockets, we should not stop our efforts. The sentiment is fine, but I can not think of anything which will accomplish this. I am forced to the conclusions which I have arrived at. I thank you for the very courteous consideration given my paper.

Dr. Rogers. I feel much as Dr. Watson, and have nothing further to say. I think the subject has been very thoroughly discussed. I also believe there is a large field for us to investigate. We are only making a beginning now. Possibly somebody may next year give a paper far in advance of anything we have reached to-day.

Base Metal versus Noble Metal Appliances in Orthodontia.

By Clarence Jones Grieves, D.D.S., Baltimore, Md.

In these latter days of many written words and few thoughts those who rush into print should promptly apologize at the very beginning or show "reason for the faith that is in them." The object of the investigations reported herewith is to obtain, if possible, ideal materials which exposed in the human mouth will accomplish quickly, definitely and finally the movement and retention of teeth and at the same time do no damage to denture, associated parts and the general good health, and still be not offensive in appearance.

All agree that these ideals are next to impossible and with reason such are the various and ofttimes directly opposing physical force required in one small appliance exposed in a persistently trying electro-chemical environment; all also agree that the materials now generally in use are glaringly defective; therefore the writer will feel amply justified if he "but scratch the matter."

In approaching this subject we find our interest centered at once in the damage existing in the form of corrosion or disintegration of both teeth and appliances which in this instance could be produced only by acids acting at minute distances, such are the dilutions of the human mouth, and resulting from an acid producing environment.

A careful review of the latest and best thought on enamel decalcification in early life shows, that in mouths predisposed to caries there are but two environs necessary, *i. e.,* contact making "a retention center" of the carbohydrate media for ever present bacteria and protection of such contact that the gelatinous plaque, their habitat, may be undisturbed to the production of inorganic acids.

It is accepted that this is the usual method of acid production in the normal child mouth; fortunately we have little or nothing to do with the vitiated saliva of later life charged with the acid sodium phosphate, or oxalate series, or lactic acid caused by the neuroses or faulty metabolism; but granted such diathesis the mechanical contact center between tooth and appliance would be just as retentive of even a higher acid media, and hence more electrochemically active to the destruction of both teeth and appliance.

So the conditions are virtually similar and the orthodontist, in inserting appliances, frequently produces these damaging environs. Conditions differ so markedly with different appliances, the time of, and method of retention on the denture, that the writer perforce (and with no desire to raise again the discussion of methods) classifies all orthodontia appliances according to *method and time of retention.* Recognizing any classification as broad and necessarily defective, we have as follows:

Class I.

Appliances removable only by the operator, which may be divided into

Division A.—Arch bars, retainers, etc., with anchorage bands attached mechanically by bolts, etc.

Division B.—Arch bars, retainers, etc., with anchorage bands attached by some cementing medium.

Materials.—All alloys—German silver, plain or gold plated, platinum and iridium; 20 k. to 18 k. platinous gold, 18 k. to 14 k. spring gold, plain or gold plated. Coin gold and platinous coin gold.

Solders.—Gold, silver and soft solder.

Ligatures.—Silk, flax, rubber, sea grass and brass wire occasionally gold plated.

Class II.

Appliances removable by the patient, which may be divided into

Division C.—Wire cribs, spring plates, etc., in contact with tooth structure at few points, comparatively open, removable by the patient for cleansing and usually exposed to the "pump" of mastication.

Materials.—Same as Class I, often fixed to vulcanite, German silver or silver plates, plain or gold plated; steel wire springs, large masses of soft solder.

Division D.—Retaining combinations of united bars and bands in close contact with the teeth so comfortable as to be rarely removed.

Materials.—Same as Class I, Divisions A and B.

With the general idea of ascertaining the behavior of the different materials now in use and so differently applied a careful study has been made; *first,* of the teeth and appliances *in situ* by the use of the Greenough binocular microscope; *second,* of the same just as taken from the mouth with low powers, later cleansed, cut to sections and examined with higher powers; *third,* the corrosion of appliances and teeth, how many, where and when most likely to occur; *fourth,* of the discoloration collected from used appliances and the saliva chemically as to the quantity and quality of salts and the acids concerned in formation; *fifth,* of the effect on the patient of the continued ingestion of such salts; *sixth,* physical laboratory tests of different alloys to determine relative flexibility, rigidity, tenacity, hardness, etc.

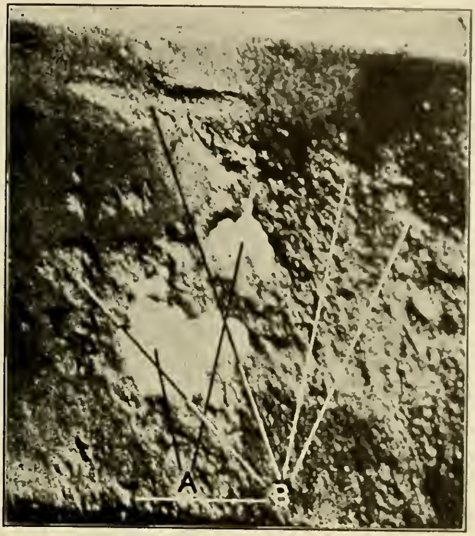

FIG. 1.

Fig. 1.—Tooth side of proximal section of gold-plated German silver anchorage band worn uncemented for three months, showing complete perforation of No. 26 gauge metal from electrolysis. (a) Perforations; (b) craters of bright metal by electrolysis, surrounded by dark sulphid deposits.

Here follows a careful tabulation of the results of the microscopic work under headings, "first," "second" and "third"; forty persons were examined by the binocular microscope; over four hundred appliances of all sorts were examined with low powers, many of these direct from the mouth, many sections were cut of wire, bars, bands, teeth, ligatures, plates, etc.

Referring to the classification by method we have under

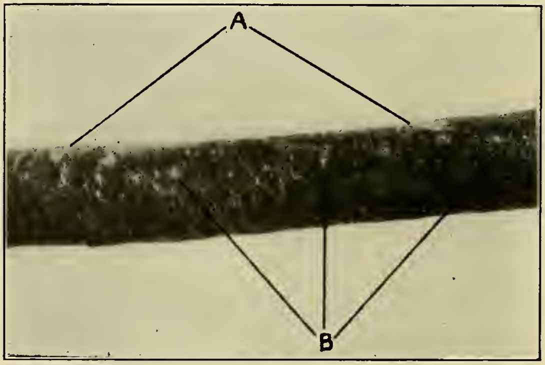

FIG. 2.

Fig. 2.—Corrosion of plain German silver arch worn two months. (a) Side in tooth contact; (b) higher craters; note that they occur first in tooth contact; later, all over.

Class I.
Division "A."

Plain German silver bars, bands, tubes, etc.—Exposed for a short time.—Corroded only in food retention centers; along the gingival line, particularly approximately, under bands and where ligature crossed bars; no etching whatever where parts were kept clean as by lips, cheeks and tongue, or where ends of arch bars were concealed in well-closed tubes.

Exposed for a longer time.—Corroded *all over* with loss of metal in retention centers where corrosion first began (Figs. 2 and 4).

Gold-plated German silver bars, bands, tubes, etc.—Loose plating in spots in retention centers shortly after exposure; following the rule above as to procedure and time of exposure the corrosion is much more violent and rapid than in the plain German silver, frequently proceeding to perforation of anchorage bands (Fig. 1) and destruction of the parts of arch bars adjacent to the teeth (Figs. 4 and 5).

No corrosion of bands under the gingival line.

Brass buccal tubes on anchorage bands and nuts on arches do not corrode so rapidly or deeply as does plain German silver (Fig. 3).

Platinum and iridium, 20 to 18 k.; platinous gold, 20 to 18 k.; gold where no zinc occurred in alloy.—Undamaged though discolored by sulphids by deposition and not corrosion; deeply stained where wire ligatures were in contact (Fig. 6).

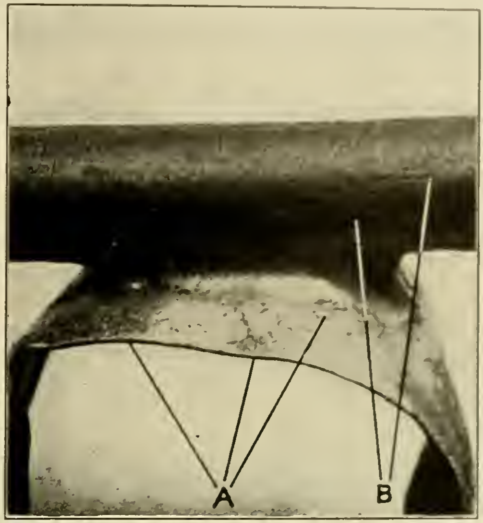

FIG. 3.

Fig. 3.—Section of German silver anchorage band with brass tube, after two months' wear. Note the craters of corrosion in the German silver at (a), and lack of such in brass tube; plier marks at (b).

Fourteen k. gold alloyed with nickel and heavily gold plated.—Not damaged, appearing as above, but when gold plating was lost due to wear, some etching.

Platinous gold with zinc, or 18 k. gold with reducing alloys of brass like gold solders.—Corroded slightly in retention centers; after long exposure all over.

Solders.

Sulphidization begins first in German silver appliances, plated or unplated, where silver or soft solders attach tubes, hooks and screws; the gold-plating is lost here immediately and corrosion occurs around such centers. This is true in a less degree with any lower karat gold solders than 18 k., particularly when the reducing alloy is brass or spelter.

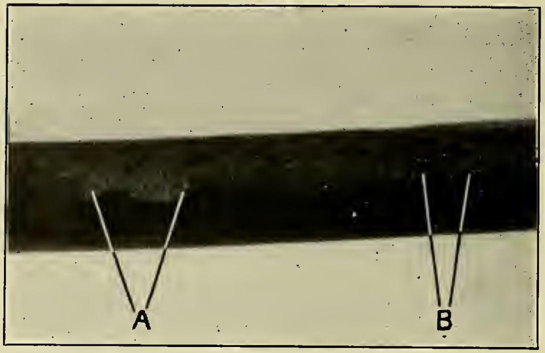

FIG. 4.

Fig. 4.—Front view of tooth side of gold-plated German silver arch, one month; (a) retention center "sore" of craters, beginning of corrosion; (b) corrosion and sulphid stain, ligature crossing.

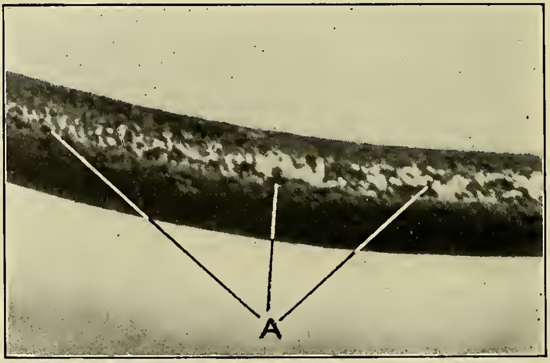

FIG. 5.

Fig. 5.—Corrosion of gold-plated German silver arch worn two months. (a) Crater occurring first at points where gold is lost

Ligatures.

Brass wire corroded quickly, often eaten almost through near arch crossings and approximately producing dark lines of salts on such crossings (Fig. 7).

Damage to the Teeth.

Whenever food retention centers occurred and were maintained, by anchorage bands about molars; at the tooth side of arch bars in tooth contact or crossed by wire ligatures, or upon approximating

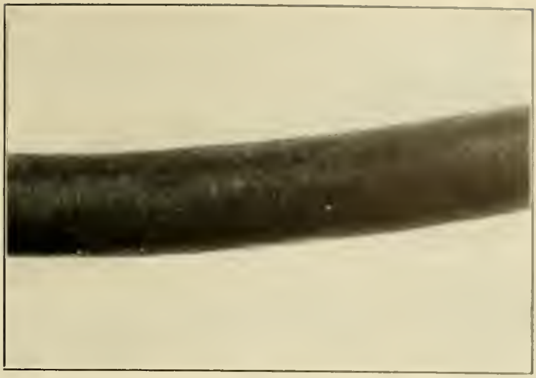

Fig. 6.

Fig. 6.—Platinous gold arch after four-months' exposure in the mouth; dark stains are from brass wire ligatures; no corrosion

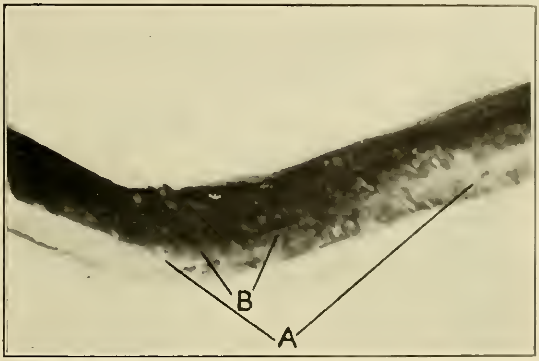

Fig. 7.

Fig. 7.—Section of brass wire ligature crossing gold-plated German silver arch, showing rapid corrosion. (a) Part exposed to retention center; (b) deep crater almost perforating at arch crossing.

surfaces near ligatures, etc., the enamel was frequently decalcified with exposure of the rod ends and disintegration of the inter rod substance and occasionally initial caries (Fig. 10).

These decalcifications were deep, proportionate to the time of exposure and shelter afforded from the "churn" of saliva in mastication and the cleaning movements of the lips, cheeks and tongue.

With the plain and gold plated German silver (particularly the lat-

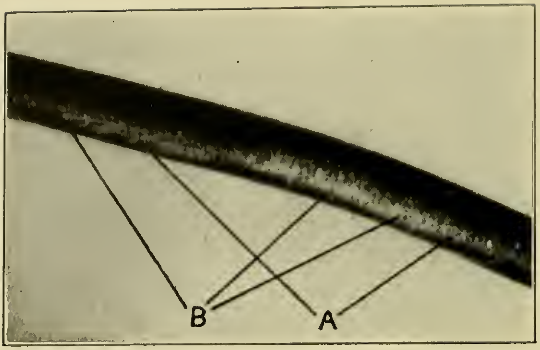

FIG. 8.

Fig. 8.—Section of plain German silver wire (finer gauge than same enlargement) from band retention center of removable crib appliance, as Class II, Division C. (a) Side in tooth contact; (b) small craters.

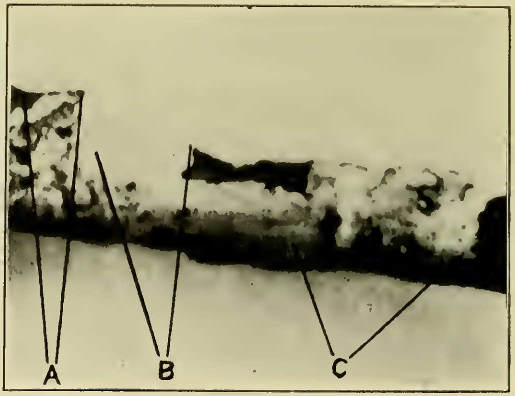

FIG. 9.

Fig. 9.—Rapid corrosion of piano wire—steel—six-weeks' wear in vulcanite split spring plate. (a) Original gauge; (b) crater almost severing wire; (c) salivary calculus.

ter) 14 k. gold, plain and plated, where plating abraded off, there occurred in the order named deposits of dark salts on the roughened enamel (Fig. 10); these stains came off in buffing and did not penetrate the decalcified inter-rod substance as does silver nitrate.

Platinum and iridium, platinous golds, and the higher karat golds having little or no zinc in the reducing alloys, all did greater damage to the adjacent tooth structure than German silver, decalcified lines and spots were common, well marked and white without salt staining (Figs. 15, 16).

Class I, Division "B."

Here all the metals in arches, retainer bars, wire ligatures, tubes, etc., behaved exactly as in Class I, Division "A"; the effect, however, on anchorage bands was vastly different, the inner surface of which remained clean and bright, except where leakage occurred, as when first set, due to the protecting power of the cement and there is yet to be found one corroded through, although on the outer surface and particularly at the gingival line the pitting was marked and typical.

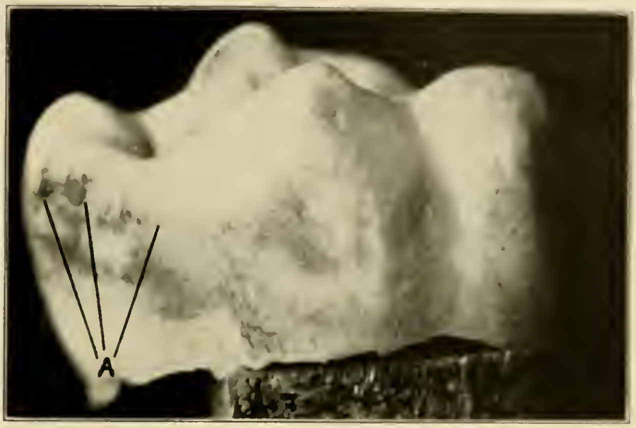

FIG. 10.

Fig. 10.—Enamel decalcification, proximal surface, temporary molar, occurring under gold-plated German silver anchorage band, retention screw, no cementing needed. (a) Decalcified area. Set for a little over two months, experimentally, by Dr. J. Lowe Young.

Effect on the Teeth.

The damage to the teeth was the same except under anchorage bands where the difference was marked; the enamel had been perfectly protected by cementing substances and no decalcification occurred except an occasional fine line at band edges which was slight.

Class II, Division "C."

Plain German silver cribs, springs, etc. exposed for a short time.—Were etched adjacent to food retention centers, but to nothing like the extent of the fixed appliance, many showing little damage (Fig. 8).

Exposed for a longer period and when gold plated.—The corrosion was deeper and extended finally all over the appliance. The gold plating was markedly defective.

It is rare to find platinum and iridium and gold of the higher karats in these appliances and there was no appreciable defect in that examined nor in the vulcanite retention. The masses of soft solder forming the bulk of many such appliances corroded like cheap amalgam and the steel or "piano" wire in springs was completely eaten out and disgustingly filthy (Fig. 9).

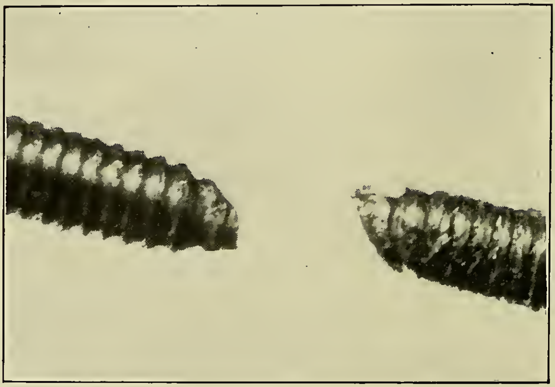

Fig. 11.

Fig. 11.—Reduction and fracture of threaded end of platinum and iridium arch under a load of 102.5 kilograms. Test Bureau of Standards.

Effect on the Teeth.

There was little or no appreciable effect on the tooth structure adjacent to these open fitting removable appliances; an ocasional line occurring in a few cases where they were not removed, but it is rare to find a case where they are not frequently removed.

Class II, Division "D."

The metals behaved in this division as in Class II, Division "A."

Effect on the Teeth.

The greatest enamel decalcification noted in these investigations was found under and about uncemented anchor bands, or bands which, cemented, had sprung loose in the fixed retainer forms apparently so comfortable as to be rarely removed; enamel disintegration with staining was the rule in German silver, and deeper white destruction of the enamel rods in the noble metals (Figs. 10, 16, 18 and 19).

To the most casual observer it is obvious in studying the foregoing data that the orthodontist is subject to the same laws, the result of experience and confirmed by chemistry and bacteriology, which have always governed those who attach any appliance in the human mouth. Be it a partial denture or the clasp attaching it, an interdental splint or obturator; a loose bridge abutment or a filling; when in such close contact as to prevent the cleanliness incident to the "laving churn" of mastication and the movements of the cheek, lips and tongue, and still not so loose as to become detached, in the dental tissues adjacent thereto, in a mouth predisposed to caries, there is produced either enamel decalcification primary to caries or true caries ofttimes extremely rapid (Figs. 18 and 19). Nothing is safe near a dental surface unless so near as to exclude saliva or so open as to allow acid dilution by saliva or as to be removed and cleansed.

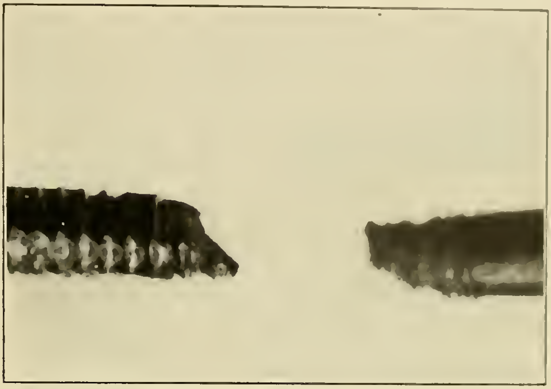

FIG. 12.

Fig. 12—Reduction and fracture of threaded end of platinum gold arch under load of 100 kilograms.

Orthodontia is carried on in what might be termed the carbohydrate food period, or carious period of youth, particularly dangerous to the teeth of our race; a period not comparable with the later more immune time when artificial dentures are usually inserted.

It is also established by the data that less corrosion results to both denture and appliance when the appliance is of Class II, Division "C," cribs, springs, plates, etc., removable by the patient for cleanliness and open in contact with anchorage teeth, and we are "twixt the devil" of accomplishing orthodontia and the fear of ever finishing it correctly with these open appliances, and "the deep sea" of promptly and exactly obtaining results by fixed appliances at the risk of damage to the teeth.

We are bound to be governed in the selection of methods by majorities; that accepted by the greatest number of operators interested and giving in their hands the greatest, most exact and lasting results is the arch with fixed anchorage bands, and if there is one fact resulting from a study of the data more prominent than another it is that every part possible to fix about fixed appliances should be carefully fixed with cement to exclusion of fermenting and retained food, and arches and ligatures should be removable for frequent cleansing. Note the damage to the teeth under Class I, Division "A," and Class II, Division "C."

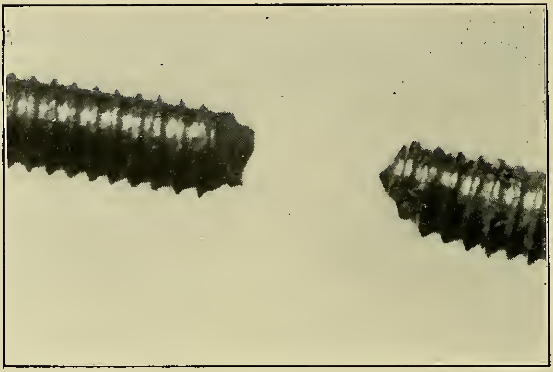

FIG. 13.

Fig. 13—Brittle fracture without reduction of German silver threaded arch under a load of 74.8 kilograms.

There exists an astonishing lack of exact data in our literature as to the alloys daily exposed in the trying mouth environment and we find little of real worth as to the physical characteristics of the metals—all alloys—which are used in orthodontia. For instance, German or nickel silver in very general use, originating long ago in China as *packfong,* composed almost entirely of nickel, may be now almost anything, provided it contains copper, nickel and zinc, so different are the given formulæ.

After much correspondence to discover what we were really using, it was decided to have assayed chemically the appliances as sold in the open market. Five of different grades of rigidity were selected and for fear of change that acid or heat might make they were filed and buffed free of all soldered attachments and gold plating.

German Silver Assay.

	Copper	Zinc	Nickel	Tin	Iron	Reduced by 10				
						Cu.	Zn.	Ni.	SN.	Fe.
B. Very soft retaining wire	61.8	25.9	12.1	...	.2	6.18	2.59	1.21	...	02
C. Medium Retraction Arch	59.1	20.2	20.7	...	...	5.91	2.02	2.07	...	...
D. Rigid Expansion Arch	65.0	21.1	13.5	...	.4	6.5	2.11	1.35	...	04
E. No. 1 Molar Anchorage Band	58.4	23.2	18.4	...	...	5.84	2.32	1.84	...	...
F. No. 2 Molar Anchorage Band	60.8	18.4	20.6	trace	.2	6.08	1.84	2.06	Tr.	02
					5)	30.51	10.87	8.53	3)	.08
						6.10	2.17	1.70	...	.026

NOTE—The trace of Tin is no doubt due to the fact that all solder was not removed.

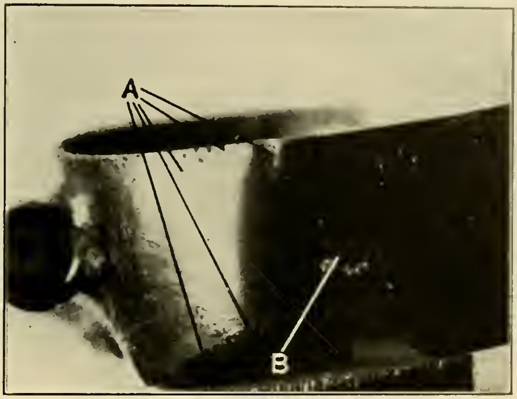

FIG. 14.

Fig. 14.—Platinous coin-gold anchorage band, four-months' wear showing no corrosion and little staining. (a) Plier and file marks; (b) salivary calculus.

The first fact of consequence in the assay is that the formula has little to do with the variety of physical characteristics found in the alloy; for instance, iron is not an impurity, but is added to give rigidity and color. Nickel, also, adds rigidity and yet we find nickel 1.2 and iron .02 in the soft retaining wire "B" and only nickel 1.5 and iron .04 in the rigid expansion arch "D" with copper the same. Such rigidity and hardness as these alloys possess is therefore obtained only by physical treatment, *i. e.,* drawing into wires from higher gauges or rolling into plates (Fig. 13); the heat of soldering will reduce all rigidity and flexibility so obtained to the normal alloy which as here assayed is soft and ductile.

It is difficult to understand how high fusing metals such as nickel, copper and iron are ever fused to alloy with volatile metals like zinc without complete destruction of the zinc.

We are told that brass is made first and then nickel added; the proportion of nickel in the composite formula is nickel only 1.7, to copper 6.10 and zinc 2.1. This is good brass stiffened by nickel. It may be not unlike the alloying of platinum and gold where the finely divided platinum, protected by the melting gold from an oxyhydrogen heat which volatilizes gold before the platinum melts in cooling settles to the bottom of the crucible.

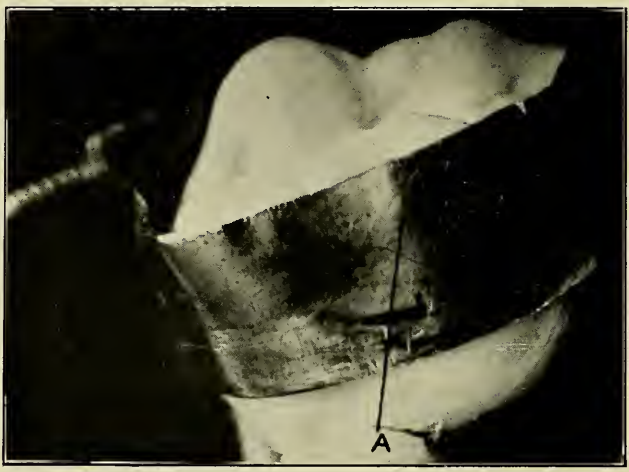

FIG. 15.

Fig. 15.—Palatal surface of upper temporary molar covered by coin-gold anchorage band, screw retention, no cementing needed, for five weeks; experiment by Dr. F. C. Kemple. Note the peculiar pitch of band on disto-palatal cusp; no corrosion of band; decalcification of tooth under band at (a); dark spots are plier marks.

The making of these alloys needs further elucidation.

That German silver is a perfectly homogeneous alloy is shown by the large quantity used in the manufacture of very exact electrical resistances, and yet the zinc may be dissolved out of it just as all of the silver may be recovered from gold alloyed with silver in gold reduction.

Sorts of Metals.

To obtain practical physical laboratory tests of the different metals now in use for arch bars it was decided to have made five arches as nearly alike as possible (No. 16, Brown & Sharp gauge, thicker by about 3.45 m.m.

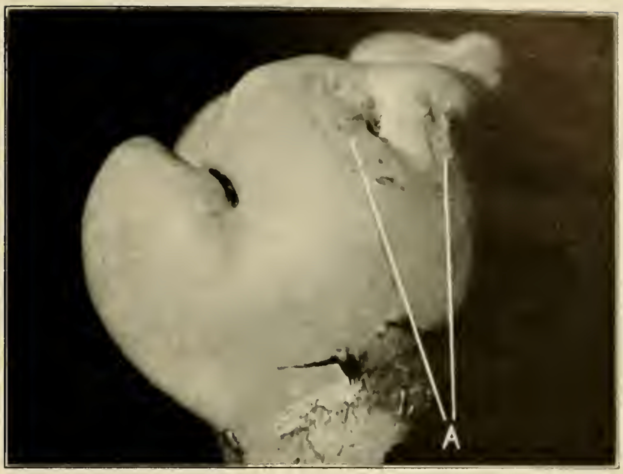

FIG. 16.

Fig. 16.—Palatal surface of upper temporary molar shown banded in Fig. 15. Spots of enamel decalcification at (a) produced at this unusual location by retention center produced by gold band. See section cut at (a) in Fig. 18.

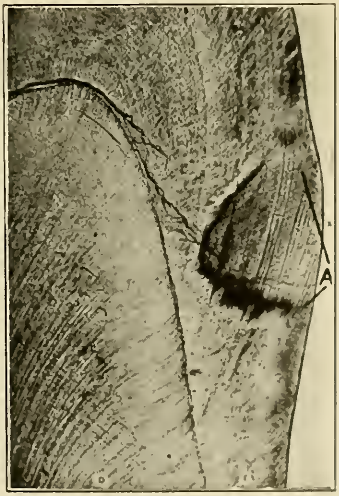

FIG. 17.

Fig. 17.—After Noyes, *Dental Review*, October, 1908—"A Presentation of Some Conditions of Caries of the Enamel." Initial caries at (a) compare with Fig. 18.

than those in the market, nuts bored out of solid metal, all threads from same plate) of the following alloys: Platinum and iridium; "X," 20 k., platinous gold; "Z," 20 k., platinous gold; "Y," German silver arch; "W," German silver arch; and 14 k. nickel "spring" gold.

These were submitted to the National Bureau of Standards for tests in ductility, tenacity, hardness, flexibility, rigidity and strength of threads. Comparative tenacity, ductility, hardness and strength of threads were practically brought out in a tension machine by removing one nut and pulling the other against a grip with a hole in it just large enough to allow the arch bar to pass through and noting microscopically the behavior of the threads stripped and the bar in fracture, etc.; if the threads stripped, it was too soft; if it fractured in a sharp line it was too brittle, and if it reduced finally under a heavy load and fractured, it had sufficient ductility, tenacity and hardness. The tests for flexibility or elasticity and rigidity were made by mounting arch bars in a vertical plane; one end of the bar open as for use was set in a fixed clip; the other received the load and a needle on a scale noted the degree of deflection in the ends. Those moving a short distance and resisting the load were too rigid; vice versa, those moving too great a distance were too flexible. An interesting feature was "tiring" of some alloys under increased load.

Report of Tests. Weight of load 200 grams, to which 100 grams were added until 700 grams were reached. Extreme deflection of needle, the distance between the ends of bars 50 m.m.

Platinum and iridium bar and nut of the same.—Alloy said to be ten per cent. iridium; from what can be gathered this is a natural alloy, the platinum occurring quite brittle native with ten per cent. iridium.

Nut stripped thread slightly; the bar reduced in gauge to taper and parted in the roots of threads under the load of 102.5 kilograms. (Fig. 11.)

Rigidity excellent (note B, D, F and total 19.5); tenacity, hardness good; ductility and flexibility fair; does not tire under load (note C and E); does not corrode; stands platinized gold solders; good color.

	Grams		*m.m.*
A	200	moved	5.3
B	300	"	3.0
C	400	"	2.5
D	500	"	3.2
E	600	"	3.0
F	700	"	2.5
Under load			——
of 700 grs.			19.5 m.m.

in total of 50 m.m.

	Grams		*m.m.*
A	200	moved	6.7
B	300	"	6.5
C	400	"	6.8
D	500	"	7.0
E	600	"	2.0
F	700	"	2.2

Under load ——
of 700 grs. 31.2 m.m.
in total of 50 m.m.

"X," 20 k. platinous gold, bar and nuts of the same.—Alloy, approximately gold and platinum 20 pts., silver and copper 4 pts., more copper than silver. Impossible to find how this alloy is made; very homogeneous.

Threads on bar and nut stripped under load of 99.6 kilograms.

Rigidity good (note B, D, F and total 31.2); tenacity and hardness good; ductility very good; flexibility excellent; note A, C and D does not tire under load (note E and F); does not corrode; stands 22 k. gold solder; good color.

	Grams		*m.m.*
A	200	moved	5.8
B	300	"	6.4
C	400	"	9.6
D	500	"	5.4
E	600	"	3.3
F	700	"	1.8

Under load ——
of 700 grs. 32.3 m.m
in total of 50 m.m.

Clasp or spring gold, "Z" 20 k. platinous gold bar, nut of 14 k. nickel gold.—Alloy approximately gold and platinum 20 pts.; silver and copper 4; equal parts.

Bar broke in the root of thread without stripping under a load of 100 kilograms. (Fig. 12.)

Rigidity fair (note A, C, D and total 32.3); tenacity poor; hardness good; ductility poor; flexibility good; (note A, C and D), tires more than preceding under load (note E, D, C); does not corrode; stands 22 k. gold solder; good color.

	Grams		*m.m.*
A	200	moved	5.8
B	300	"	5.7
C	400	"	4.3
D	500	"	4.2
E	600	"	4.2
F	700	"	1.3

Under load ——
of 700 grs. 25.5 m.m.
in total of 50 m.m.

"Y" German silver bar and nuts made from commercial German silver.—Alloy approximately copper 6.1, zinc 2.1, nickel 1.7, iron .02.

Bar broke in the root of thread under load of 101 kilograms with sharp brittle fracture.

Rigidity fair (note A, C, E); tenacity poor; hardness good; ductility poor; flexibility fair; does not tire under load (note B, D, F); corrodes; more gold plated than plain; stands 18 k. gold solder, but becomes soft; color bad, plain or gold-plated.

	Grams		*m.m.*
A	200	moved	8.0
B	300	"	5.7
C	400	"	7.6
D	500	"	5.0
E	600	"	5.4
F	700	"	6.6

Under load ——
of 700 grs. 38.3 m.m
in total of 50 m.m.

"W" gold plated, German silver bar and nuts as manufactured; nuts presumably made from tubing.—Alloy approximately copper 6.1 zinc 2.1, nickel 1.7, iron .02.

Arch bar broke in root of thread under load of 74.8 kilograms with no reduction of area, but a sharp fracture.* (Fig. 13.)

Rigidity poor (note A, C and F); tenacity poor; hardness good; ductility poor; flexibility good; tires under load (note A, E, F); corrodes more gold plated than unplated; stands 18 k. gold solder, but becomes soft; color bad, plain or gold-plated.

	Grams		*m.m.*
A	200	moved	10.7
B	300	"	8.5
C	400	"	4.1
D	500	"	6.4
E	600	"	4.5
F	700	"	15.8

Under load ——
of 700 grs. 50.0 m.m
total possible deflection

14 *k. nickel spring gold, bar and nuts of same, gold plated.*—Alloy approximately gold 14 pts., copper, silver and nickel, making up the 10 pts.; proportions unknown.

Nut stripped of threads and pulled off at 68 kilograms; arch not damaged. Rigidity very poor (note A, C, D and F); tenacity fair; hardness very poor; ductility excellent; flexibility poor; tires completely under load (note A, C, D and F); solder with 18 k. gold solder, getting somewhat softer; color good; does not corrode when plated nor lose gold plating except from abrasion.

It will be noted at a glance that the 20 k. platinous gold, without zinc in alloy, measures up best to all of the requirements for expansion and contraction arches. Platinum and iridium and the platinous golds are sufficiently rigid for retainer bars. German silver, in fact all of these alloys are sufficiently strong for any work required in the mouth.

To settle the much discussed question as to the relative wearing values of hard nuts on softer arches or vice versa, or nuts and arches of the same material, a nut of 20 k. platinous spring gold ("Z" in the list) softer than the platinum and iridium arch was run on it and stripped in the threads of the nut under a load of 95 kilograms.

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*It is significant that the wire of both of these bars fractured under the load indicating that flexibility and rigidity were induced by previous physical treatment, sharp fractures such as these could never occur in an alloy of copper 6, zinc 2, nickel 1, unless its molecules were strained by the draw plate. (Fig. 13.)

A platinum and iridium nut harder than the arch was run on "X" 20 k. platinous gold and stripped the threads of the bar at load of 35 kilograms.

If these figures be compared with the load necessary to strip the platinum and iridium nut, bar of same we have:

Arch platinum and iridium, nut same	102.5 kilograms
Arch platinum and iridium, nut softer	95.0 kilograms
Arch 20 k. platinous gold, nut harder	35.0 kilograms

These results are what might be expected, and indicate that bolts and nuts for anchorage bands, which meet more stress than nuts on arches, should be of the same metal. Further, according to Seller's law, there is a direct relation between size of nut and the thread on arch (Seller's threads are those in use in orthodontia), nothing is gained in holding power or strength by having the nut any longer than the diameter of the bar plus one-third, unless such depth is for retention in a tube, as in connection with arches.

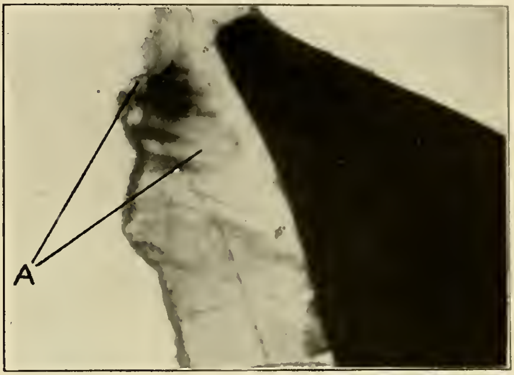

FIG. 18.

Fig. 18.—Slide of slow enamel decalcification cut, at (a), Fig. 16. Enamel rods intact, complete loss of cementing substance at (a), compare with Fig. 17.

Anchor Bands.

The study of quite a number of used anchorage bands with the lens where the band was made of coin gold (gold 90 per cent., copper 10 per cent) and platinous coin gold (coin 21½ parts, platinum 2½ parts) show most excellent results in wear and no corrosion: the bolts on these bands made of "X" 20 k. platinous gold with small nuts stood the stress of use well. (Figs. 14 and 15.)

Ligatures. The question of the best materials for ligatures is the weakest point in this paper, and no suggestions can be offered except that some alloy of gold be found to serve the purpose; the brass now in use stretches and breaks down quickly from corrosion, and is not to be thought of. (Fig. 7.) Silk and linen thread collect filth and set up gingival irritation.

Damage to Teeth. The embarrassing question of damage direct or indirect to the teeth by presence of orthodontia appliances is one of the most important in this connection. It has been noted that not infrequently white lines and spots, sometimes stained black or brown, appear about or under bands and arch bars. The causes have been mentioned, and there remains to be determined the kind of acids having found the source of such.

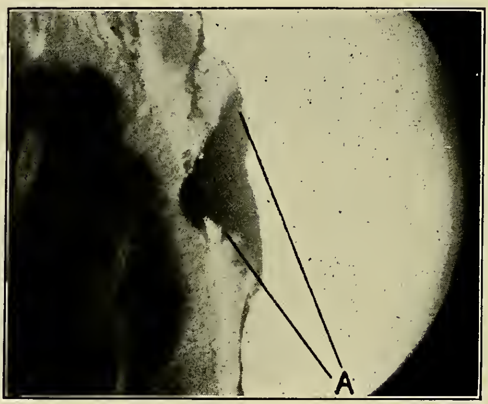

Fig. 19.

Fig. 19.—Control experiment; rapid initial caries with decalcification of both rods and cementing substance under an uncemented band, removed, not cleansed, examined and replaced every month; (a) did not occur until the third month.

Notwithstanding the numerous theories advanced as to the causation of dental caries, the researches of Miller, made thirty years ago, stands unassailed. Lactic acid principally, with acetic, butyric and valerianic acids in small quantity, the product of fermentation in the human mouth, produced by bacteria in a carbohydrate media, are the primary factors in decalcifying the enamel initial to caries. According to Noyes (*A Presentation of Some Conditions of Caries of Enamel," Dental Review,* October, 1908) decalcification of enamel is to be divided into two distinct phenomena, differing only with the degree of acid formed. *First*, the rapid destruction of both rods and the inorganic matrix cementing such, due to intense acid and producing a well marked cavity (Fig. 19) and, *second*, the more slow, but just as serious, solution of the inter rod substance, due to more dilute solution of the same acids, the rods appearing in this instance in well ground slides "like a picket fence," interfering with the coefficient of refraction and presenting in white lines and spots (Figs. 17 and 18). These enamel trauma often appear to the unaided eye like the histopathological spots in newly formed enamel, referring to which the same author says, "In the white spots in enamel there is more or less complete failure in formation of the cement substance, but perfect rod formation."

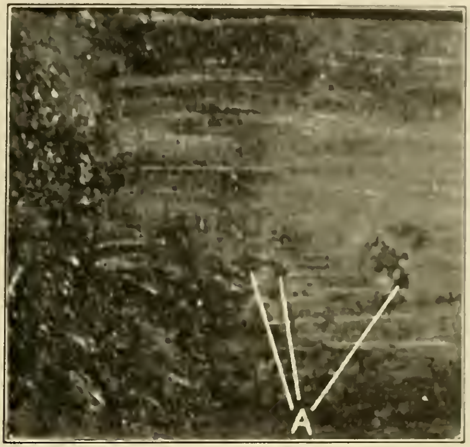

FIG. 20.

Fig. 20.—Section of German silver gold-plated anchorage band just as purchased; (a) gold-plating lost, spots showing red and green salts. The autochromatic slide gives these colors perfectly, but it is impossible to produce them in print.

It is with the second of these conditions that the orthodontist has most to do, as he often induces it by the continued presence of appliances adjacent to tooth structure.

The assertion frequently made and backed by a long line of clinical evidence, that there occurs deeper and much more rapid decalcification of enamel in teeth surrounded by bands of noble metals, particularly platinum and iridium, as compared with German silver, was established by the following experiment.

On two upper temporary molars in the same mouth (having slight carious cavities approximately—it being next to impossible to obtain others in the mouth for experiment) were set without cement, by Dr. F. C. Kemple of this Society, an anchor band of German silver on the right and of coin gold on the left, August 15, 1908; the teeth were extracted and examined September 29, 1908. (Figs. 15 and 16.) The molar on which the German silver band was placed was stained at points

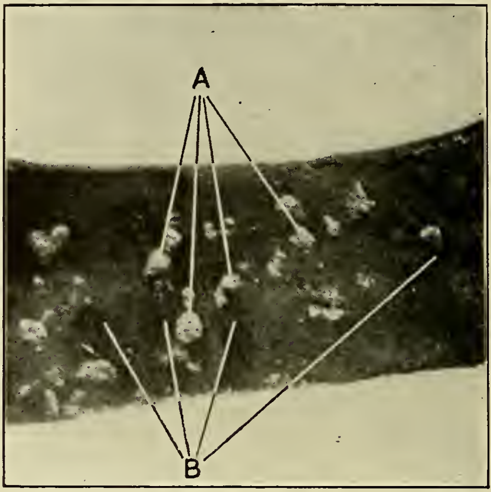

FIG. 21.

Fig. 21.—Tooth surface of gold-plated anchorage band, buccal section, showing white amorphous flower salts at the edge of crater (a); dark crater at (b).

wherever the band touched it; these stains easily removed, were collected, and together with others analyzed later; the tooth was carefully examined at those parts, farthest from where the band surrounded the carious cavity and found to be very little damaged. The molar bearing the gold band was treated in the same way, no dark stains were noted, but at a point most distant from the cavity of decay (the band had worked up until it covered the disto-palatal cusp—a point unusual for enamel decalcification), a series of white lines were found (Fig. 16); this tooth was honed to section and is presented herewith, showing decalcification of the inter-rod substance (Fig. 18) like the early caries shown in the slide from Noyes (*Ibid.*) (Fig. 17).

Another slide cut from a temporary molar set and watched by the writer shows caries from four months wear of a loose German silver band; there is a true caries of the first form mentioned; the band was removed once a month (and replaced not cleaned) and tooth examined. The cavity is of recent and rapid origin (Fig. 19).

Some effort was made to induce these conditions by cultures out of the mouth; a perfectly sound molar on which was set a gold plated German silver anchor band was exposed for two weeks in a culture of *B. acidi lactici*, in Witte's pepton and glucose with the proper degree of alkalinity maintained, necessary for such. This tooth was carefully examined before and after placing in the media with no appreciable result, except on the band as will be noted later. The technique may have been defective, or time of exposure short, in this test.

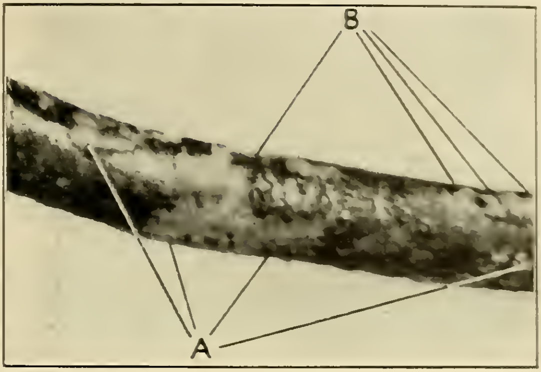

FIG. 22.

Fig. 22.—Lower gold-plated German silver arch, showing deposits of green salivary calculus at (a); deep crater of corrosion at (b). Much better shown in autochromatic slide.

The rapid enamel decalcification occurring clinically and confirmed by experiment under the noble metals as compared with German silver is highly significant; further, it is to be accepted as the normal in the human mouth, as proven by the even more rapid and complete carious degeneration of abutment teeth under one end of a fixed bridge, loose for a few weeks; the complete carious cavity as noted in the latter stages of the wearing of the German silver band and produced by violent acidity (Figs. 18 and 19), is of import and convincing, showing a first deterrent action by the German silver band developed early in its placement which later it lost, allowing rapid caries to begin.

The solution of this problem is to be found in the study of the corrosion of German silver appliances, plated and unplated, in the mouth.

which is most interesting. A reference to the tabulation given in this paper will show that those portions of appliances exposed to the inorganic acids formed in retention centers they create are attacked like the teeth in such centers (Figs. 4 and 7); after a longer time, however, *and unlike the teeth the whole appliance shows corrosion even on parts which are always kept clean, as the labial surfaces of arches* (Figs. 5, 2 and 8).

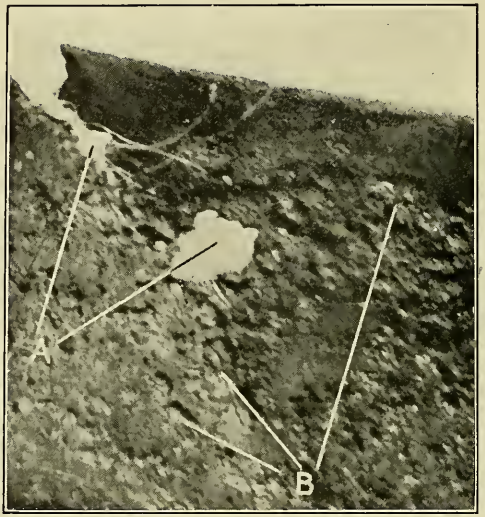

FIG. 23.

Fig. 23.—Tooth side of palatal section of gold-plated German silver anchorage band worn uncemented for nine weeks. Showing electrolysis to perforation at (a); deep craters, almost perforating, at (b).

This is to be noted because it shows some other agency at work than acids, or presupposes a general mouth acidity almost as high as that of the retention center, where the acid is generated, "nascent," so to speak.

Discolorations.

A study of the appearance of salts of discoloration existing on used arches and bands to the number of nearly four hundred has been made, and chemical analysis had as follows:

Corroded German silver shows deep craters of what appears to be pure metal, brilliant, crystalline, as freshly fractured as zinc (Figs. 1, 5 and 23).

Surrounding such craters when first found are amorphous flower-like white salts, rather rare and very difficult to collect (Fig. 21). These have not the consistency of salivary calculus, which is hard, well organized and regularly crystallized in deposit, occurs freely and is not infrequently stained from an apple-green to a greenish blue (Fig. 22). All other and older corroded surfaces are covered with dark salts, in hue from a copper through the browns down to a bluish black and black; these are more constant on the parts of the bar first attacked, but on long exposure become general. Further, when gold plating occurs (and it seems to be impossible to electroplate German silver, defective spots occur where the gold rolls up and drops off) (Fig. 20) this disintegration is very much more rapid and violent (compare Figs. 1, 5 and 23 with Figs. 2 and 3). (Noted by V. E. Barnes, *Orthodontia Materials, Dentists' Magazine*, May 2, 1908.) Working under the hypothesis that the inorganic acids alone produced corrosion, from the whole lot of appliances, together with teeth stained by same, after a great deal of trouble there was collected a few milligrams each of the white amorphous salts and the dark stains, commonly called oxids; these were submitted for chemical analysis. The dark salts proved to be insoluble sulphids of copper and nickel, not germicidal in the least.

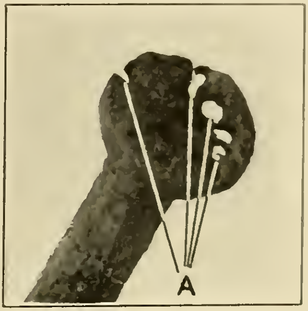

FIG. 24.

Fig. 24.—Reduced view of head of a 12-inch galvanized (zinc) iron bolt taken from the copper-sheathed hull of a ship. The threaded end was nutted to the iron hull and exposed to the air; the head (here shown) was exposed to what sea water—a good electrolyte—could filter through the wooden plug lying directly against the copper sheathing. These conditions are ideal for electrolysis; quiet dripping of sea water leading from copper via galvanized iron surface to the iron hull. The whole bolt caliber is greatly reduced, honeycombed in craters, as at (a) —such as could not have been produced by oxidation.

The sulpho cyanates are to be considered in this connection. In a communication from Dr. J. Wright Beach, who has done work in this line, he states that, while the normal saliva of children under sixteen contains sulphocyanates, in his opinion it would not be in sufficient quantity to damage German silver. Dr. H. D. Pullen (*President's Address, Society of Orthodontists,* ITEMS OF INTEREST, January, 1908) says that potassium sulphocyanate very badly discolors German silver; tests made out of the mouth (always to be doubted) show sulphid discoloration, but little or no corrosion of German silver. In the culture tests of gold plated German silver (reported later) those parts of the appliance exposed to the air of the tube, and all silver soldered joints, show under the microscope an array of multi-colored salts. These were, undoubtedly, produced by hydrogen sulphid from decomposing nitrogenous matter in the culture. Mendeleff (*Principles of Chemistry*) describes hydrogen sulphid as acting almost as violently as an acid: "the light metals, and copper and silver evolve hydrogen when in contact with hydrogen sulphid in the air, producing dark metallic sulphids, as from silver near the skin." So it is more than likely that these sulphids are produced by the free hydrogen thrown off by the electrochemical corrosion of German silver, and being insoluble where deposited on the teeth and appliance, the sulphids of zinc, light and soluble, are probably broken up and ingested.

It has been asserted that these dark salts could in some germicidal way protect the etched enamel surfaces on which they were deposited. Even if the analysis did not show such salts to be sulphids, perfectly inert as bactericidal agents, the supposition is paradoxical, for if acids acted on German silver to produce germicidal salts in saturation sufficiently strong to reach the distant tooth and to protect it by deposition they would be self-limited, and by very virtue of their germicidal action delay or stop the growth of bacteria which produced the acids. Copper amalgam, and its aseptic action on carious dentine, has been used as an illustration in this connection. The cases are similar as to causes for breaking up of the copper, but dissimilar as to deposits of salts.

Dr. E. C. Kirk has explained that copper amalgam is made by depositing copper electrolytically into mercury; in its use oxids are formed, which existing in a mass with particles of pure copper, under the saliva as an electrolyte, and due to a difference in potential, local electrolysis is set up with a deposit of salts into the tubular dentine, the contact with which is practically adhesive consequently, the salts are protected in slowly depositing.

A band about a tooth is open in comparison to such a filling and is washed to dilution by the saliva; enamel is not porous and if the inter-rod substance be decalcified sufficiently to permit deposits of protective salts, the actual damage is done, which the salts are expected to prevent. Again, if these salts were sufficiently active to protect the teeth, the continued ingestion of such, even in the dilutions of the human mouth, might be attended by serious consequences to the patient, and would be the best possible argument for not using any such metal.

The theory that these suphids are germicidal has been used against the application of gold-plated appliances and in favor of plain, reasoning that more salts would be formed from the plain appliances, hence, greater protection of the adjacent dental tissues. Just the reverse is true; gold plated German silver disintegrates much more violently and rapidly, forming more salts in the saliva than does plain (Figs. 2 and 5). What really happens is the frequent removal and buffing necessary for appearances, in the use of plain arches, disturbs the culture spots, preventing acid formation, and reducing the corrosion to such described in Class II., Division "C" (Fig. 8).

It is quite likely that the green stains in salivary calculus are the ordinary salts of nickel (apple-green) and copper (greenish-blue) formed very slowly in small quantity under the protection of the calculus and staining the whole mass. The white salts gave a strong reaction for phosphorus and proved to be phosphate of copper and zinc. This was disappointing, as it was expected that lactic acid acting on the metals would produce lactates, which, while known to be soluble, might give some signs of their presence.

Examination of Saliva.

It was determined next to analyze samples of saliva of children wearing German silver appliances for some time and showing marked corrosion. A number of such samples were requested from members of this society and five received, two other samples were collected; out of these seven only three were worth analysis, for this reason: It was found a very difficult thing to get the composite of several weeks' saliva, because children will not collect the 50 c. c. necessary to accurate analysis in small quantities daily, but insist on filling the bottle in a day or two. It is obvious that even with large masses of German silver in the mouth, under most active degeneration, the proportion of salts would be infinitesimal. The colloid substances in the saliva might easily, by protecting corroding surfaces, interfere for a day or two with the formation of salts, and the very act of drawing quantities of saliva from the mouth would "clean up" and interfere with the very process in which we are interested.

All of the samples submitted, together with the two obtained by the writer, were open to this objection. In two of these analyzed, furnished by Dr. Kemple, it was found later that the whole 75 c. c. had been collected in three hours, and, of course, absolutely no metallic salts were obtained. The spark spectra test for metals was also applied with a similar negative result.

The third, D. V. E. Barnes's specimen from a mouth, where plain German silver corroded badly—time of collection about three days—after very careful work gave a slight reaction for copper; not enough to be convincing.*

With the idea of definitely settling the matter small cultures of *B. acidi lactici,* Witte's peptone, to which glucose and alkalinity sufficient was added, were prepared; in one was placed a gold plated German silver arch and in the other a 20k. platinous gold arch; the third contained a gold plated German silver "D" band, each one half exposed to the air of culture tube to get the action of any gases, if such were found. After two weeks these were carefully examined microscopically with no other effect than the action of the hydrogen sulphid on the soldered portion of the "D" band, and sulphid staining on the gold plated German silver arch; the platinous gold was not disturbed nor discolored.

Corrosion of German Silver.

The theory that acids alone corrode German silver in the mouth is defective; *first,* because no matter how long the exposure, the bar or band would suffer only, as a tooth does in the retention centers (Fig. 4), while it is well known that after long exposure the whole bar corrodes, even in the clean spots (Fig. 5). We have no reason to expect a greater degree of acidity or a general acidity of saliva in a child using a bar four months than one month. General acidity of the saliva can come from defective metabolism, yet all the children wearing bars cannot so suffer, while the degeneration of German silver arches is remarkably constant as to primary and general corrosion in all children.

Second, a greater and more rapid enamel decalcification, hence, a greater degree of acidity has been noted and proven under noble metal (Kemple's experiment, Figs. 10 and 16) than under German silver bands, yet all things being equal, carbohydrate food retention, hence acidity, should be the same in each for the same mouth. So we have something in the presence of the German silver bands which either delays the formation of acids or breaks it up after being formed. *Third,* after continued application of the German silver band we have enamel decalcification like that occurring under noble metal bands, showing a pronounced diminution of the force preventing acidity (Fig. 19). *Fourth,* it will be noted from the tabulations that gold plated German silver disintegrates much more rapidly and violently than does plain German silver in the same mouth (compare Figs. 2 and 15), which should not be the case if acids were the only factors. The craters occurring first about the spots where plating is lost have the appearance of those found in the metals comprising the common wet electric cell (Figs. 1, 23 and 24).

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*It is suggested that this is committee work impossible to accomplish alone.

In discussing the electrochemical theory of decay advanced by Bridgman and Chase, W. D. Miller (*Micro-organism of the Human Mouth,* pages 137-141) gives an experiment with a zinc tooth filled with gold, exposed in an electrolyte (nearly all solutions, particularly of salts and acids, are electrolytes); the zinc tooth was rapidly decomposed because the whole zinc surface became electro-positive (the oxygen side) to the gold, which is electro-negative (the hydrogen side). *What is of greater import to us is that the electrolyte in which the tooth was exposed was also decomposed;* the basic portions appearing as ions, or groups of atoms. It is generally accepted that all substances in solution, except certain colloid materials exist, not as salts in water, but in a state of electrolytic dissociation; thus, in a solution of sodium chlorid the ions of the metal sodium are electro-positive to the ions of chlorin, which is electro-negative.

Referring to the table of Berzelieus of electro-positive and negative substances we find the metals appearing in plain and gold plated German silver, gold and copper high in the scale of electro-negative substances, zinc just as high in the electro-positive, with nickel very near it and distinctly positive to gold and copper. So any retention center between gold plated German silver and tooth becomes a little battery (Fig. 24), just so soon as the gold plating fails in spots (Fig. 20), and the acids are formed in sufficient quantity to attack the exposed metals (Fig. 4). That the action is violent the slides fully show (Figs. 1, 5 and 23), and it is limited respectively either by dilution of the acids by mouth fluids, by a coating formed by some of the colloid substances found in saliva, which are not electrolytically dissociative, or, what is most likely, complete electrolytic dissociation of the media and all contained in the retention center, delaying further bacterial growth, followed by the deposition of insoluble metallic sulphids on the corroding surface.

Relative to the action of dissociation as a bactericidal agent little has been written, but it is established that in passing light currents through culture tubes in testing electricity as a germicide electrolytic dissociation occurred in the culture making the media an electrolyte to the destruction of bacteria (Cohen and Mendelsohn, quoted by Sternberg's *Bacteriology.*)

The dissociated metals produced by electrolysis exist in solution in the saliva, as ions, and unite as suggested before, or are ingested as such.

The coatings of insoluble sulphids protect the fresh craters (Fig. 2), but in turn they become retention centers (Fig. 5) in which fresh cultures grow, fresh acids are formed, recharging the battery again; new spots are attacked to the ultimate electrolysis of all surfaces (Figs. 1, 23 and 24).

Miller (*Ibid.*) has shown that enamel is absolutely a non-conductor of electricity and can have no part in electrolysis, except that of passively suffering from the products of it. The rapid decalcification under noble metal bands is confirmative, for about such bands and bars there can be absolutely no electrolytic dissociation; so we have the retention centers under these noble metal bands undisturbed to the formation of cultures, which are not dissociated, as they are under German silver, and therefore produce rapid degeneration of the adjacent enamel (Figs. 15 and 16).

The platinum, iridium, gold, copper and silver entering into noble metal appliances are all practically electro-negative to each other; the enamel of the teeth is a non-conductor and all of the acid resulting from bacterial growth spends its force upon the tooth, while in German silver electrolysis occurs and the action is all along the line of the appliance.

It is also interesting to note that when very small portions of zinc exist as in the higher gold solders reduced with spelter or even in 20 k. platinous gold alloys (as shown in tabulation), electrolysis begins and corrosions exist; this is the greatest proof possible of the correctness of the theory of electrolysis of all appliances containing base metal.

It is possible to successfully gold plate these zinc alloyed golds, even in the lower karats of 14k. to 10k., giving freedom from electrolysis, except where abrasions expose the original metal.

A study of old bridges where German silver "dutchman" had been used and exposed in finishing will show electrolysis of the German silver, with craters cut just as in gold plated German silver.

The rapid degeneration and breakage of brass ligatures crossing platinous gold or gold plated German silver arches (Fig. 7) as compared with more lasting wear over plain German silver arches is due to electrolytic action.

All of the brass appliances examined except those in contact with noble metals or gold plating, such as ligature crossings showed less damage than did plain German silver (Fig. 103). This fact but confirms the idea of electrolysis; in brass we have but one electrolytic opposite each, viz., copper and zinc; in gold plated German silver; gold and copper opposed to nickel and zinc.

One of the most striking features of the inspection of many gold plated German silver anchorage bands is the immunity to corrosion that passage under the gingival line affords, all of the gold plating being intact under that line, a complete row of craters, just at it and loss of gold plating beyond it; to the writer's mind this is a confirmation of the idea that the gingival secretion is colloid to the prevention of electrolysis.

Toxic Effects of Metal Appliances.

The toxocology of the metals, copper, and zinc and nickel which go to make up German silver is worth consideration, but it cannot be elaborated sufficiently to be convincing. As zinc and nickel are very slowly absorbed via the gastro-intestinal tract, like copper, and as they form such a minor portion of German silver as to be almost a negligible quantity, they may be considered systemically under copper.

Cushny (*Pharmacology and Therapeutics*) says, when a solution of metallic salts comes in contact with mucous membrane of the mouth or stomach the albumen displaces the acid portion of the salt, forming an albuminate more or less stable. The major portion of a dose of metallic copper will pass through the gastro-intestinal tract unabsorbed unless there are abrasions or continued use of the remedy produces local ulceration in the mucosa. That absorbed passes directly into the blood according to Kobert, attaching itself to the red blood corpuscle at once. Taken by the mouth it does not produce poisoning, because it is so slowly absorbed and is withdrawn rapidly from the blood by the liver.

Ryan (*Copper in Human Liver,* University of Pennsylvania, *Medical Bulletin,* June, 1907) found it constant in the liver not as normal, but accidental, derived from copper-bearing foodstuffs, many vegetables and oysters containing copper.

Slowtzoff claims it forms stable albumen compounds, such as the nucleinate in the liver, and because of their stability it is excreted slowly. In copper and brass workers, acute febrile gastro-intestinal catarrh, nausea, vomiting or colic and diarrhea, followed by paralysis, with green discoloration of the skin occur. "Brass founders ague" is rare and due to inhalation of gases in casting, but anemia even to chlorosis is common with enlarged salivary glands. In toxic doses the central nervous system and the kidneys, by which it is excreted, are involved, particularly after long ingestion. It is apparent that the only danger in the use of German silver in the mouth is from the continued ingestion of its disintegration products.

This is precisely what happens in orthodontia; the average quantity of German silver exposed to mouth fluid is as follows:

	Grains	Whole tie-up
One anchorage band weighs....	11.39	Four bands weigh...45.56
One arch cut to suit weighs....	19.40	Two arches weigh...38.80
One average ligature weights...	.616	Ten ligatures weigh. 6.16

Total weight of "tie-up"....90.52

A gold-plated German silver arch used about a month, and of average corrosion, showed a loss of one-ninth by weight when balanced with a new one of similar measurement, micrometer scale,* the total weight of a full "tie-up" is ninety grains, thus giving a monthly dosage of ten grains of metal; from the writer's study of used appliances the second month's corrosion should be in greater ratio than the first, and unquestionably there can be found many cases of children wearing German silver appliances with slight symptoms of metallic poisoning.

Of two cases of alternate constipation and diarrhea, accompanied by colic, and one case of chlorosis in an adult the writer is personally cognizant; on the removal of the appliances, *at the physician's suggestion,* the cases cleared up. Two other cases, one of anemia and one of enlarged submaxillary glands, the writer has on good authority, both recovering on removal of appliances. These could hardly all be coincidence, and it would not be well to state before this audience that such were caused by malnutrition due to crippling mastication by the orthodontic appliances.

The fact that there are comparatively few cases of metallic poisoning in children wearing masses of German silver and soft solder in connection with gold in the mouth for long periods, may be explained not on the basis of the chemical corrosion of the metals, with daily ingestion of salts formed, for if such were the case, symptoms of metal poisoning would be the rule rather than the exception, but rather on that of electrolytic dissociation producing the ions of these metals and salts, that the daily dosage is of metallic copper, nickel and zinc, which it has been shown are slowly absorbed.

May we not now raise the question of just how seriously we shall be taken as a profession which in one breath plumes itself on mouth prophylaxis and in the next preaches the continued use in the same mouth of so filthy a thing as corroded German silver?

What of our status with our medical confreres called by the laity when systemic conditions in our little patients demand a consultation, if the removal of such appliances (ordered by them) and the clearing up of the symptoms are so closely associated as cause and effect?

Dr. Pullen (*Ibid.*) quoting a goldsmith, says, "Gold is a metal capable of alloying in so many different ways that it is possible to at least duplicate if not excel any of the qualities possessed by the alloy German silver."

The foregoing statement, in the humble opinion of the writer, has been more than verified in the paper (compare Figs. 5 and 6 with Figs.

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* The defects in this comparison are known to the writer but it was all possible in the time available.

14 and 1), German silver by every count has been proven unfit for use in the mouth, and the mystery is, why we have used it so long.

It has never been a question of expense, we are sure, the cost of an appliance is in direct ratio to the labor, not the material consumed in its manufacture. Twenty karat platinous gold appliances cost but one quarter more than gold plated German silver appliances, and they may be then cashed at one-half on the original cost, or boiled, altered, polished and used many times again. Who would think for an instant of using a German silver arch a second time?

If the use of noble metal appliances becomes general the orthodontist will be compelled to see his patient more frequently than heretofore, and completely removing all arches and retainer bars (which, if possible, should be made removable without disturbing cemented anchorage), give careful prophylactic treatment at least once every two weeks, for while cement will protect teeth about and under bands, the tooth contact points along the line of arch and ligatures will do greater harm to the enamel than German silver if not so disturbed.

The sentiment of our beloved profession as to materials has always been of the very highest type, one of which we might justly be proud; "the best" has ever been "none too good," and we are sure that this society will subscribe again to it in the words of Dr. C. N. Johnson, slightly transcribed, who said recently: "Nothing yet devised by the ingenuity of man, or even distilled in the great alchemy of nature, is quite good enough to go into a human tooth (mouth)."

The writer wishes herewith to make all due acknowledgment of help had in mouth experiments to the members of this society; for physical tests to the National Bureau of Standards; for analysis and assays to Professor M. R. Schmidt, of the Johns Hopkins University, Department of Chemistry; for Bacteriology, to Dr. Clausses, Johns Hopkins Medical School.

Discussion of Dr. Grieves's Paper.

Dr. C. A. Hawley. No one here can question the results which we have had presented before us. They can only be disproven by a long and exhaustive study of the problems, as Dr. Grieves has given. We are extremely fortunate in having a man to investigate the matter as carefully as has Dr. Grieves, and fortunate in having him present it as one who is not practicing our specialty. His report is thus impartial. We must discuss such matters in an absolutely scientific manner.

His findings agree remarkably with my own clinical experience. For the last two years I have had considerable experience in the use of the noble metals. I have said many times that I did not think I injured the teeth either with German silver or with the noble metals. The question now is whether I have not injured many teeth in both ways, for I have not examined those teeth microscopically. I believe we have had injuries to teeth with both metals. Since using the noble metals I have found that patients wearing such arches need more attention.

I have no doubt that in many cases the care of the mouth can be such that German silver can be used without much detriment, and as Dr. Grieves has found, it has its value: there is an element that makes for the preservation of the tooth. Now, whether the detrimental influences of that metal are such as should cause us to abandon its use, is the question for us to determine. I took up the use of the precious metals mainly from the standpoint of their strength. I have made a number of tests of noble metals in comparison with German silver as to their tensile strength. Those were made at first by a man in the State University of Columbus. He has now moved to Iowa.

In three sets of tests the counts favored the noble metals. It has been stated during the past year, in one instance at least, by the editor of the Orthodontia Department of the *Western Dental Journal*, that German silver is the stronger; that no metal will take its place when rolled into thin strips. The tests made by Professor Fish have disproved that. I did not get as great strength with it in thin strips as with iridio-platinum.

In tests recently made, one sample of German silver, of the thickness of clamp bands and of the same width, has shown greater strength than a similar piece of iridio-platinum. That is the only one that has shown equal strength in my tests. So far as the spring of the arches is concerned, the tests I have made have been in favor of the platinous gold arch. I had intended to bring with me a little instrument for testing in ounces the spring of these materials. I took many old arches and tested them; also new arches. There is no value in the German silver as to spring power over the noble metal arch, nor in the life of the metal.

After nearly two-years' use of platinous gold arches, so far as the injury to the teeth is concerned, I may report as follows: I have not examined teeth with a microscope, but with the naked eye. My experience is that there would be more danger than where German silver is used, but this danger can be entirely obviated by proper care of the patient. In no case, where the patient has taken proper care of the teeth, and received proper attention from myself, has there been any injury to the teeth. I think the detrimental influence can be entirely obviated by proper care of the patient, but it means greater care, and that is something which we should all take into consideration in future.

Dr. Rojo. I wish to thank the essayist for his excellent paper; he has beautifully shown his experiments, and explained fully how bad the German silver appliances are. I have been testing all these appliances and I agree with him that the noble metal appliances must take the place of those constructed of German silver.

Dr. Rogers. In his discussion Dr. Hawley brought up the point that it is possible to prevent any ill effects on the teeth by proper care of them. I have discovered a very effective method which may be used by the patient. Use a very small brush, with a single row of bristles. If the nurse or mother is instructed in the proper use of this brush, excellent results will be gained. I have been so impressed with the advantages of this brush, to be used by the children, that I purchased two or three dozen of them and wish to present one to each member. I wish each one of you to take one of them, remembering the fact that it will accomplish wonders when used in accordance with proper instructions.

Dr. Hawley. I have used this roller brush referred to for more than a year, and always give the patient instructions as to how it shall be used.

Dr. Kemple. I wish to express my delight at listening to this paper, because I believe Dr. Grieves has presented a subject that is of vital importance not only to the orthodontist, but to every dentist who attempts the correction of malocclusion in any way. It is gratifying when a person can have his own humble opinions supported by such proof as Dr. Grieves has presented. In Detroit last year Dr. Pullen introduced this subject of noble metals versus base metals, as used for regulating appliances, and in the discussion at that time I referred to the more careful cleansing of the teeth which I thought would be required where the noble metal appliances are used. In some of the reports of that discussion I was credited with recommending the use of German silver appliances in preference to those of noble metal; but I did not do that, because I have not been using the German silver appliances.

In regard to the point made by Dr. Rogers, I have felt the difficulty of securing the cooperation of the patient with one or two exceptions, or of the parent or nurse, to such an extent as would insure the absolute cleanliness of the child's teeth, whether they use the rolling tooth brush or any other. Dr. Rogers gave me one or two of the little tooth-brushes having the single row of bristles in Boston a year or more ago, and since then I have had my patients use this brush, along with the other brushes. I believe the responsibility of cleaning the teeth rests absolutely on the shoulders of the orthodontist. We can not depend upon the patient, parent or nurse for keeping the teeth clean. The arches and ligatures must be taken out of the mouth at very frequent intervals and the surfaces of the teeth polished. I can see but one way of accomplishing that, and that is to remove the appliances, and not only cleanse the labial and lingual surfaces, and make use of floss, etc., but to polish every interproximal surface. I want to thank Dr. Grieves for the points he has brought out in the paper, and to express my appreciation of his devoting himself as he has to such an exhaustive study of the subject.

Dr. Barnes. I am thankful we have had such a paper presented in so able a manner. It is thoroughly scientific. Dr. Grieves has spoken about the devil and the deep sea; it is true we are in such a position. We get certain effects with German silver and certain effects with the noble metals through carelessness. We may draw this conclusion: that as much of our treatment as possible must be expended upon the temporary teeth. There we can eliminate the decay problem and produce an effect on the permanent teeth without much actual application to the permanent teeth. We must realize the fact that the children must keep the appliances clean. Many of these cases show us the very worst of mouth conditions.

One fact might be considered in the use of German silver which has not been brought out, and that is, if the appliances made of German silver should involve the principle of fixation in one direction and flexibility in another, so that the teeth can move, that will have the effect of renewing the surfaces of the German silver. A certain friction is thus produced. I think Dr. Grieves's conclusions must make us realize that we must eliminate ligatures as much as possible; also, that we must cement bands to place. We must have no gold plate where we use German silver. If we use noble metals it must be with a distinct warning to the patient. In the German silver, if discoloration ocurs, that is a warning to the patient that cleaning is required.

Dr. Young. Dr. Grieves told us in the beginning he was simply scraping around the edges of the subject. I hope he will keep on, because I think he has given it a pretty good dig. I would like to ask him in regard to the x and z spring gold which he spoke of testing as to the load it would bear, whether it was annealed or not?

Dr. Grieves. It was just as it came from the manufacturer. The jeweler did not anneal the gold. It was just as it was purchased.

Dr. Young. Did you purchase the gold in the gauge in which you used it?

Dr. Grieves. Yes.

Dr. Young. I think you will find, if the two arches are annealed, the one that has the least copper in it will be much softer and have nothing like the spring that the other will have, and, consequently, you can solder the one with 22 k. solder; *i. e.*, arch hooks, and still maintain the spring, while with the other one you can not.

Dr. Grieves also spoke of ligatures. I have been talking with him about the ligature question, and I want to pass around a ligature I had in a mouth for probably ten-days' time. It is made of sterling silver wire, and you will observe that where twisted over the arch it is very black, while all the rest of it, which was under the gum margin, is as bright as when placed in the mouth. I have been using these ligatures but a very short time, but so far as I have used them, they work more nearly like the brass wire ligature than anything I have found. I have used gold ligature wire for two years, but it has not proved satisfactory. This silver wire I believe will work out very nicely. I am satisfied that it is a mistake to use brass wire ligatures around a gold arch. I have come to the same conclusion as Dr. Grieves in that respect. As I reported in Detroit a year ago I have had trouble because of dissolution of the enamel surfaces on the anterior teeth, upper and lower. I believe when we exclude all base metals from the mouth we will have very much less trouble with any deleterious action on the teeth from gold appliances.

Here is a raw silk ligature which may be secured in Paris. I told Dr. Grieves I like it because it shrinks for a long time, but that it does become foul and set up irritation. I suggested sterilizing, or treating it with ten per cent. silver nitrate. He suggested using another solution. Van Horn and Sawtelle told me absolutely that silk ligatures will not shrink. I replied, "Then I have not been using silk; for the material I have used will shrink for five months in constant use." I sent a couple of skeins to Mr. Sawtelle; he now says it is silk. I said, "Then you are wrong." Last Friday he told me he thought he would be able to treat this material so that it will be permanently sterile in the mouth, and if he does, I believe that between the silk ligature and the silver wire, we can dispense with anything else for ligatures. The silver wire was in part annealed, and part not. Unannealed silver will be bright, and the annealed will have a whitish appearance. You can only procure the silver wire to order. It was originally prepared for use in surgery.

The essayist also spoke of systemic troubles from the effects of German silver. This is a subject that I would like to hear more about, especially from the men who have been at this work for a number of years, and using German silver appliances. I have had one patient where it was a very grave question if there was not a systemic effect from German silver; there was a pronounced stomach irritation, and the patient has improved very markedly after the removal of German silver appliances. I am not, however, prepared to say that caused it.

Dr. Watson. Were the German silver appliances replaced with those made from other metal?

Dr. Young. The child was in so delicate a condition for a time that if the German silver was to be removed she was not physically able to have retention put in place. I hardly knew whether to take the appliances off and allow her to go for a time, or leave them on. I left them on for a short time; then

I removed the German silver and used retainers made from precious metals, and from that time she improved.

In another case wherein four clamp bands made of German silver were used for retention purposes on the first molars, the patient wore them for two years when the upper two were removed, and last year she developed enlarged submaxillary glands. The physician consulted with me regarding the appliances in the mouth. He said he really believed the metal had nothing to do with it, but "they would feel better if it was off." I removed the appliances. I saw the patient a few days ago. The glands are almost normal and everything going on nicely. That, of course, is not concluisve either.

As to the question of removing gold arches I do not believe this to be necessary. When kept absolutely clean without removing it is much more agreeable to the patient not to have them removed and religated in the mouth. The teeth can be thoroughly polished with suitably arranged wood sticks and pumice, without dislodging ligatures at all. If you use silver ligature wires I think you need not worry about polishing under the ligatures themselves.

Dr. Ottolengui. Why not?

Dr. Young. Because I do not think they will be very uncleanly. The ligature remains perfectly bright under the gum.

Dr. Ottolengui. If I understand the essayist at all, the danger is at the point of contact between the gold arch and the teeth. I can not see what the ligature has to do with it. If you keep the arch in contact with the teeth the ligature simply assists in holding it there, whether the ligature be sterile or not. The danger is at the point of contact between the arch and the tooth.

Dr. Grieves. The ligature is merely a mechanical force there. Strictly that.

Dr. Young. I take exception to that. With brass and gold, for a high and a low electric potential, I believe there is electrolytic action set up such as you do not get with gold or silver ligature wires.

Dr. Ottolengui. That may have a deleterious effect on the arch, but not on the teeth.

Dr. Young. I believe it does have an effect on the tooth.

Dr. Grieves. Silver in the table is classed rather near gold, and you have less action electrolytically with silver than with brass, because brass has zinc in it. Therefore, there would be more damage from the silver than from the brass wire over a gold arch.

Dr. Ottolengui. That is true, but when you use a silk ligature you have no such action at all. Is this caries caused by electrolytic action, or prevented by it? Let us understand your position.

Dr. Grieves. My idea is that caries is prevented entirely by the electrolytic action.

Dr. Ottolengui. Then the silver ligature is a bad one?

Dr. Grieves. Just so.

Dr. Young. That is what I want to get at. I have used silver ligatures only about two weeks. If there is any way to get light on the subject, I want to get it. As to the spring of the arches: I have found spring gold so much more elastic than German silver that I am using seventeen and eighteen gauge arches instead of sixteen. I have used ten per cent. of silver nitrate somewhat on teeth to prevent any bacterial growth, and so far have found it very beneficial, and no discoloration of enamel has resulted.

As to the patient failing to keep the teeth clean with appliances in the mouth, I do not agree with that statement. I have had many patients who have kept the teeth as clean as any one could desire. Sometimes the patient, and sometimes the nurse, has done it. For three years I have had my patients use not only one of these little single row tooth-brushes (roller brush, baby size), but four of them; one is used after each meal and one upon arising. They use them to brush around the appliances after using the regular tooth-brushes. These brushes are only made of soft bristles, and, if they are used two or three times a day, they become so soft that they are ineffective.

Dr. Ottolengui. Of course, I am perfectly delighted with this paper. I was delighted when Dr. Grieves accepted an invitation to write the paper, because I knew what its character would be. Dr. Pullen last year carried us up on the top of the mountain with reference to this matter, and now Dr. Grieves has carried us down into an abyss and left us there, and I want to ask him if he can not perhaps show us the path back?

No doubt much can be accomplished, as Dr. Young says, by use of the elbow and four tooth-brushes: one can not be used three times a day and be efficient for many days. Since dentists are using "any old tooth paste," etc., Why can not we do better than that? We have a particular place to cleanse, namely, where the arch comes in contact with the teeth. I believe we are safe enough with the D bands where they are cemented to place. Dr. Grieves admits they are safe enough when cemented. We have to deal more particularly with the more loosely applied metal parts—the arch in its contact with the tooth surfaces.

Can we have something to use with the brushes to act as a chemical cleanser? I think that such an agent would operate much better than just depending on brush work.

Dr. Bogue. When Dr. Ottolengui tells us practically that a clean tooth does not decay he is very sound. When Dr. Young tells us about the electrolytic influence of gold upon brass, he is going into a garden where he is not acquainted. He speaks of a certain silk, which I have been using now for twenty-five years or longer. That silk will absorb in a very few hours injurious materials enough to be dangerous. He may sterilize it as much as he will, but if it stays in the mouth it will again become contaminated. These are elementary facts, and I am glad to have them brought up as Dr. Grieves has done. It should be a great advantage to us.

Dr. Rogers speaks of the brush devised by Dr. Clapp, with the single row of bristles. There is another brush which can be had with longer bristles at the further end.

The idea of absolute cleanliness does not seem to have wholly prevailed. The instruction given in past years to place bands on teeth without cement is all wrong. Disintegration has been noticed by our president, Dr. Hawley, as even taking place in teeth adjoining the banded one. Anything that produces and retains extraneous matter in contact with the tooth is injurious. You may have all the electrolytic action you like, and while it may kill bacteria, the fact remains that there are constant changes in the mouth; the deposits are constantly being made with every meal, and have just as constantly to be removed.

In regard to the silver wire, which Dr. Young has used but three weeks, a novice knows that a post set in the ground decays just at the ground margin—not where it is fully covered. The same thing is true of his wires. The salts of silver have a beneficial action in more places than one, but the surgeons have dropped silver nitrate pretty much altogether.

Another thing which is intensified by Dr. Grieves is the detrimental influence of ligature around every tooth. If that can possibly be avoided, it should be. Dr. Grieves, perhaps intentionally and perhaps otherwise, has given that idea a great deal of force.

Patients ask us almost daily, I suppose, what brush, what powder, what wash shall I use? "Dear Madame, are you in the habit of using soap and sand every day for the hands?" "No." "Why not?" "I keep the hands clean enough without." "Very well, keep the teeth clean without."

Dr. Pullen. Dr. Bogue's caution about using silver ligatures does not appeal to me as having any value. I do not take much stock in the damage done by the electrolytic action of the noble metals so long as we have at hand a prophylactic method of cleansing the teeth. Our greatest fault lies in not giving time enough to each patient to see that the teeth are kept clean. Dr. Young does not believe as I do in the frequent removal of appliances for prophylactic measures, yet I know that the mouths of his patients are exceptionally clean.

As the silver wire may be of some value in preference to the brass, I think it better to give it a trial before discarding it as useless.

The paper of Dr. Grieves has been a source of great delight and instruction to me, and I am sure will appeal to many of you. The standpoint from which he has discussed the subject has been one from which I could not make any observations as I could not carry out the laboratory experiments in the work; it is along the line, however, suggested in my address of last year. As chairman of the Board of Censors I would like to ask Dr. Grieves to continue the work another year, as there is much of value still to be learned from just such exeriments as he has been making. The subject has been treated by Dr. Grieves from the chemical and pathological, as well as the bacteriological, standpoint. Dr. Hawley has studied the use of noble metals and German silver from the physical standpoint, testing the strength of the different wires, etc. Add to the experiments of these two gentlemen the clinical experience of those who have been using the noble metals and we must conclude that the noble metals for appliances are much preferable to the base metals. That tells the whole story in my estimation. The first consideration of a material to use in the mouth is the selection of one least affected by the oral fluids and which least affects the surfaces of the teeth. Dr. Grieves has pointed out admirably the results of the continued use of German silver. There is but one alternative, and my clinical experience adds additional proof in favor of the use of gold and platinum. In the physical aspects of the case the use of platinum as an alloy with gold raises the fusing point so that the flame of the blowpipe will not melt the alloy, and allows the greatest purity of the alloy. Iridio-platinum retaining wire can be used of smaller gauge than gold and platinum alloy, because of its greater rigidity. As has been said before, the cost is nothing. Arches may be used over again after being polished and sterilized, although I do not think it advisable.

I happened to be in Dr. Young's office some time ago, and I was pleased with his method of dealing with this question of brass ligatures. He called his assistant to the operating-room and requested her to remove all the brass ligatures, which had been kept in sealed tubes, and put them where he would never again find them; as from that time on he was not going to use them. If we will all take that stand we will make rapid progress in the use of gold appliances.

The conformation of dental and orthodontic practice to the demands of the use of the noble metals is rapidly progressing, and the essayist is deserving of our thanks for comparing the base with the noble metals to the advantage of the latter.

Dr. Grieves. I only have a word of gratitude for the time given me. As to the continuance of the work, I feel if I could, as a result of my researches, be able to point a way to prevent enamel degeneration, I would be doing something that has never been done. We have had nothing yet for practical use in the mouth in dentistry which would control the gelatinous plaque, except elbow grease and thorough cleaning. I had in mind, while preparing the paper, the idea that orthodontists would have to do prophylactic work in their own offices, and not send it to some one else to do, because they would be too apt to put the appliances right back on again. I thank you, gentlemen.

The Influence of the Premaxillæ upon the Form of the Hard Palate and upon the Septum.

By Harris Peyton Mosher, M.D., Boston.

The premaxillæ are so inconspicuous in the human palate that their existence is liable to be forgotten or their importance underestimated. This is natural because they are small bones and they become anchylosed with the superior maxillæ early, and in great part covered by them. When, however, the premaxillæ are studied in animals, they are found to be a prominent part of the muzzle. Not only are they much larger than they are in man, but the special teeth which they bear, the incisors, undergo striking variations. It is well, therefore, to come to the study of the premaxillæ in the human subject, remembering their increased importance in animals, and their great variations.

The subject of this paper is: "The Influence of the Premaxillæ upon the Form of the Hard Palate and upon the Septum." The first division of the subject can be dealt with rather shortly; the second division occupies the greater part of the paper and requires the consideration of many details. The first part of the subject has as yet a limited practical bearing; the second has a practical bearing which is immediate and most important.

The skeleton of the paper is as follows:

1. The comparative anatomy of the premaxillæ.

2. The influence which non-shrinkage and failure of readjustment of the premaxillæ exert upon the form of the hard palate.

This concludes the first part of the paper. The second and the longer part of the paper deals with the influence of the premaxillæ upon the septum. This second part of the subject is considered under the following subheadings:

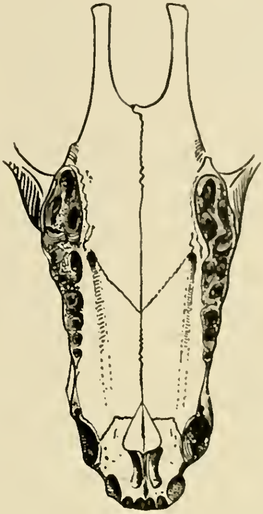


FIG. 1.
The palate of a bear.

1. The description of the premaxillæ.
2. The changes in the premaxillæ as the incisor teeth erupt.
3. The effect of delayed and irregular eruption of the incisor teeth upon the septum.
4. A description of clinical cases of delayed or irregular eruption of the incisor teeth and the nasal findings in these cases.
5. A description of the anatomical findings in specimens of deviated septa found post mortem.
6. A summary of the clinical and anatomical findings.
7. The prophylaxis of deviations of the septum.

An animal gets its living with its arms and teeth; man obtains his living with his arms and brain. In the skull of man the brain cavity dominates; in the animal the jaws and snout. The two chief changes which take place in the development of the skull of man from the skulls of his animal ancestors are the enlargement of the brain case and the shrinkage of the jaws. From the mechanical standpoint the first change is much easier to bring about than the second. In this shrinkage of the jaws in man the teeth lose two of their striking animal characteristics. All other primates except man have a gap or diastema between the incisor teeth and the canines. This gap is filled up in man so that the teeth present a continuous series. In most animals, but especially in the carnivora, the crowns of the teeth are not on the same level. In man, however, the teeth not only form a continuous series, but when they are fully erupted their crowns are of equal height. The number and the arrangement of the teeth in man show that he is not intended to be a ferocious, biting animal, but a contemplative, chewing animal. Some years ago, as you remember, Gladstone made a point of this, and recently it has been emphasized again by Fletcher in his attempt to revise our habits of eating.

In order to realize what must be accomplished in bringing about the reduction of the size of the jaws, the obliteration of the snout and the readjustment of the different parts of the hard palate, look for a moment at the palate of a bear (Fig. 1). In the bear the largest part of the hard palate is made by the palatal processes of the palate bones. The processes of like name of the superior maxillæ make the next largest part, and the premaxillæ the smallest part. In the ascent to man the parts of the palate which have changed the most are the palatal processes of the palate bones and the premaxillæ. The middle of the palate has changed but little.

The Parts of the Palate.

The palate of man, like the palate of most animals, consists of three parts: a large central part made by the meeting and fusion of the horizontal processes of the superior maxillæ; a small posterior part made in the same manner by the palatal processes of the palate bones; and a small anterior part made by the two premaxillæ which lie on either side of the middle line, and fit into the palate like a wedge. The premaxillæ are distinguished by the fact that they bear the incisor teeth. Each premaxilla carries one central and one lateral incisor.

In man the premaxillæ do not show such gross variations as they do in animals. In animals not only do they vary much in size and shape, but the teeth which they support are subject to striking variations. For instance, in animals which gnaw the central incisors are enormously overdeveloped. The tusks of the elephant are simply large central incisors. In the narwhal, an animal of the sword-fish type, there are never but two teeth, and these are central incisors. In the male one of these aborts while the other grows out into a large tusk. In the bear the premixillæ are heavy and thick, in the sheep they are light and thin. Bearing in mind the variations which are found in the premaxillæ of animals one should not be surprised to find variations in these bones in man, especially as in man both the teeth and the hard palate are subject to greater individual variations than in any other animal.

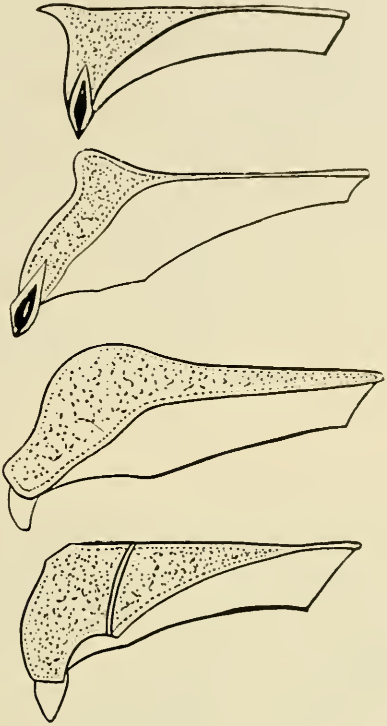


FIG. 2.

The upper figure represents a palate in which there has been normal shrinkage and readjustment of the premaxillæ. The other figures are from cases in which these changes have been faulty.

Comparative Anatomy of the Premaxilla.

According to Owen, a premaxilla is almost a constant element in an osseous skull, yet in some bats and shrews it aborts. In birds, on the

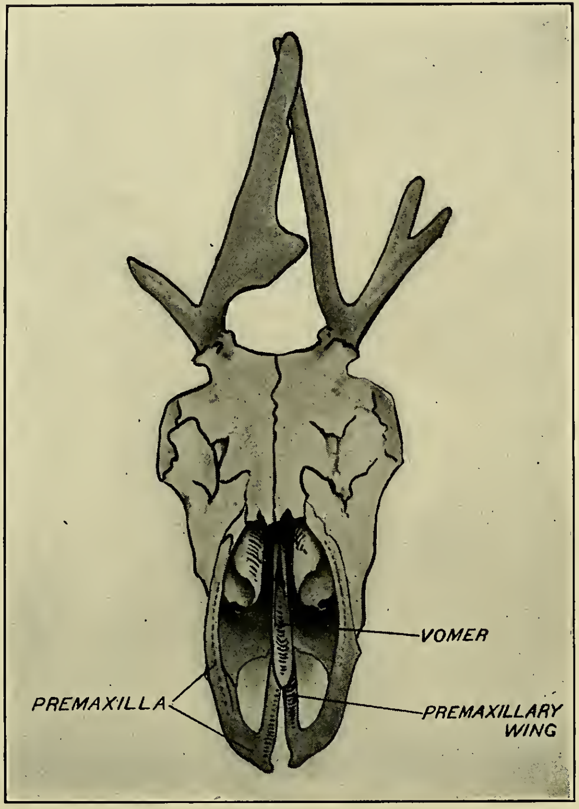

VOMER
PREMAXILLA
PREMAXILLARY WING

Fig. 3.

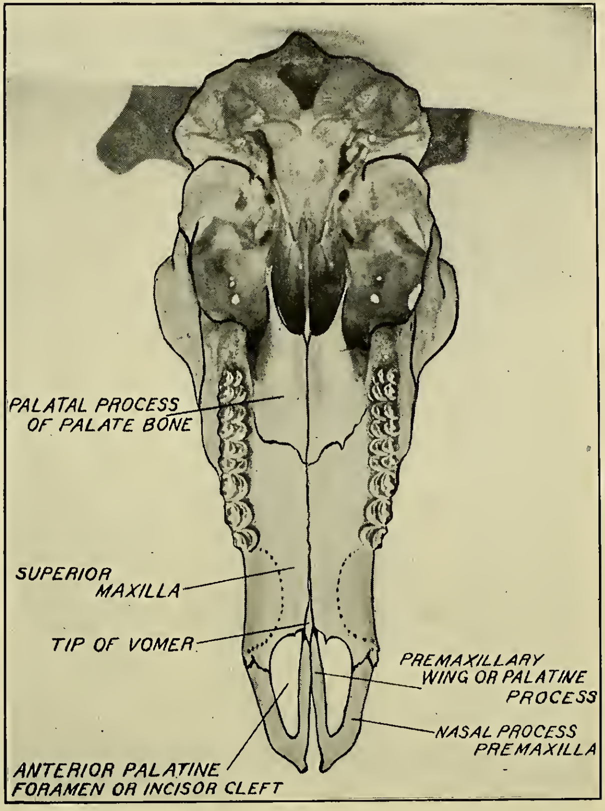

PALATAL PROCESS OF PALATE BONE
SUPERIOR MAXILLA
TIP OF VOMER
PREMAXILLARY WING OR PALATINE PROCESS
NASAL PROCESS PREMAXILLA
ANTERIOR PALATINE FORAMEN OR INCISOR CLEFT

Fig. 4.

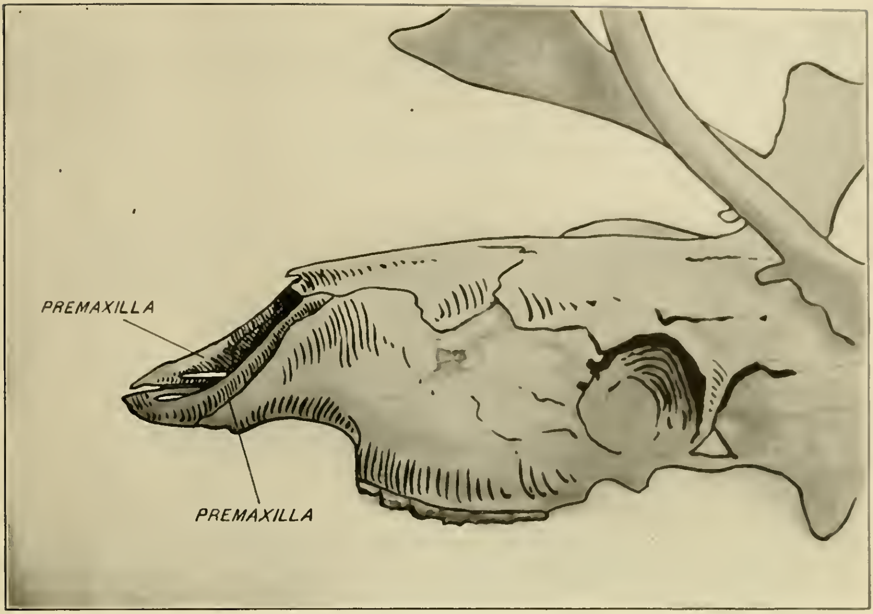


Fig. 5.

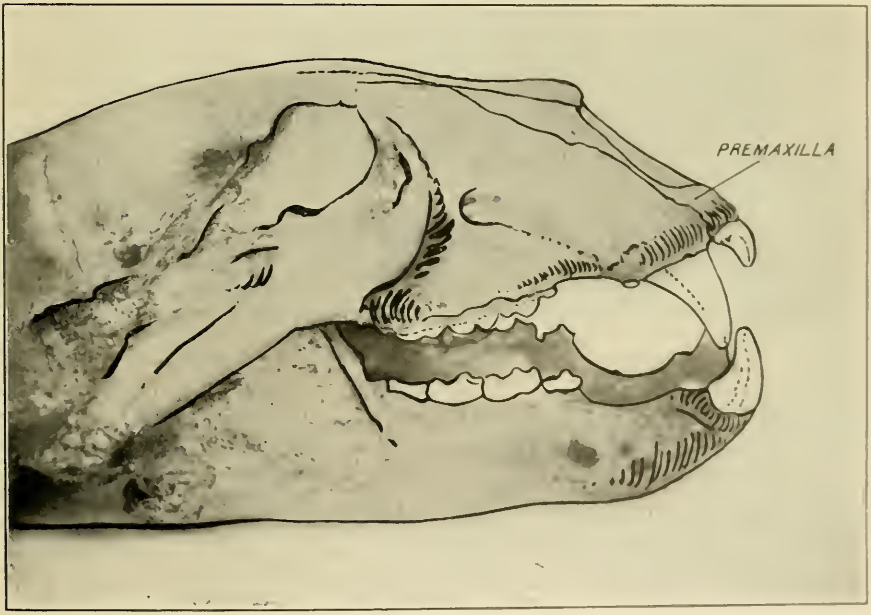


Fig. 6.

contrary, it becomes very large, forming the greater part of the upper half of the beak. It is generally double in batrachians, and apparently always so in fishes. In serpents, however, the premaxilla consists of a single median bone.

In man's class the premaxilla varies greatly in size. This may take place independently of the development of the muzzle and of the teeth, For instance, the ant-eater and certain whales are both toothless, and both have an enormously extended muzzle, yet in the first the premaxilla is small; whereas, in the second, the whale, it is excessively large. The thickness of the premaxilla, however, depends almost always upon the development of the teeth. A nasal spine, one of the processes of the premaxilla, exists in the walrus, but it is so rare, except in man, as to be practically a human characteristic.

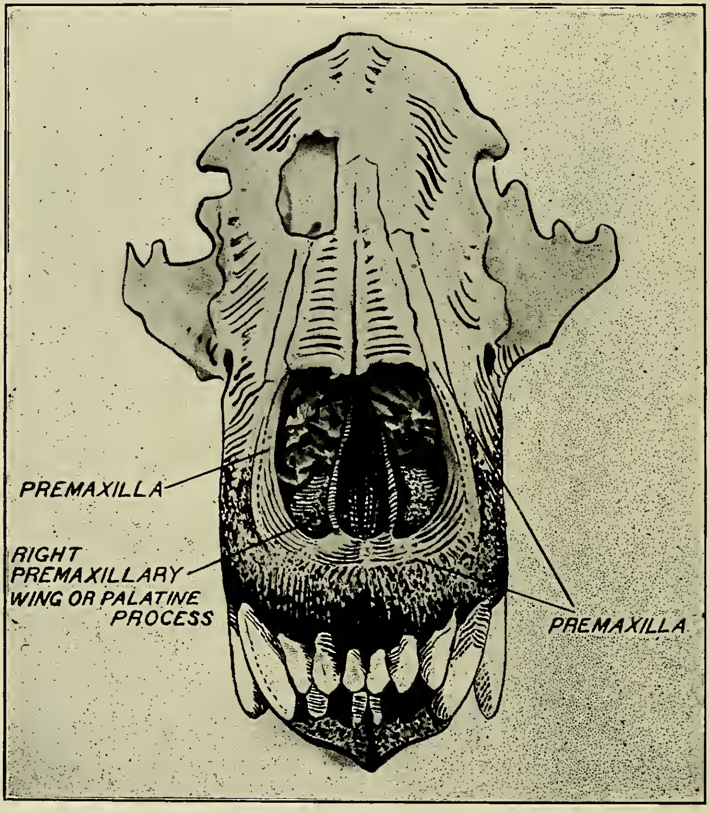


Fig. 7.

Generally the development of the premaxilla is related to the development of incisor teeth which are defined by the fact that they are implanted in it, although when they are large, as in rodents, their roots may extend backward into the superior maxillæ.

In certain bats the premaxilla is separated from its fellow of the opposite side. In some animals the premaxillæ may be united not only below, but also above, the anterior nares. Again, they may be united in the median line, but separated entirely from the superior maxillæ.

Two striking examples of the variations of the premaxillæ in animals are furnished by the skull of the bear and the skull of an elk. In the bear the premaxilla is very thick for the support of the heavy incisor teeth. In the elk, where there are no upper incisor teeth, the premaxillæ are hardly more than skeleton bones when compared with the premaxillæ of the bear. In both the groove made by the two leaves of the vomer, and by the two premaxillary wings are very marked. In the bear the premaxillary wings are very strong, in the sheep they are very slender. It is noticeable, however, that in the rudimentary premaxillæ of the sheep the premaxillary wing is a true process of the premaxilla. The premaxillary wing in man has usually been held to be a separate ossification. Dissection has led me to consider it a process of the premaxilla the same as it is found to be in the elk (Figs. 3, 4, 5, 6, 7).

The Influence of the Premaxillæ upon the Form of the Palate.

The palatal arch, with projecting premaxillæ, is characteristic of the negro race. It is an animal peculiarity and gives a very distinctive form to the face. The proper shrinkage and readjustment of the premaxillæ play a very important part in the formation of the palate. Other factors, such as the malocclusion of the teeth, the low descent of the antra, and asymmetry between the halves of the palate, also are important factors in determining the form of the palate. These factors I have considered in a paper which is shortly to be published. In man the premaxillæ must undergo two changes in order to make the normal palate. They must shrink in size and must turn downward so that the incisors may become nearly vertical. Both changes must be accomplished in the proper degree. Often, however, the premaxillæ fail to accomplish one or both of these changes. When both fail to occur the result is the negro type of palate. In the negro the premaxillæ are large and thick, and shoot markedly forward. In other respects the arch is very symmetrical. In certain other cases the premaxillæ undergo but one of the two changes necessary for the production of the normally formed palate. In such instances they change their position as they should, and bring the incisor teeth to a vertical line so that there is only the normal overhang; they do not, however, shrink in size. It is a peculiarity of the human dentition that when the teeth are fully erupted they all reach down to the same level. The anterior teeth reach their proper level first, the molars last. That is, the incisor teeth set the level which the other teeth must attain. If, now, owing to the lack of proper shrinkage, the premaxillæ are longer than they ought to be, the palatal arch will be deep anteriorly, and when growth is completed and the rest of the teeth have attained the level set for them by the incisors the arch will be deep posteriorly. Non-shrinkage of the premaxillæ, therefore, is one cause of the high arch. A high arch due to this cause is not usually pointed, but has a narrow symmetrically curved dome.

In the negro the non-shrinkage and the failure of readjustment in the premaxillæ are racial characteristics. In the white, premaxillæ of the negro type are due, I think, to faulty eruption of the incisor teeth, and, perhaps, in part to trauma. The premaxillæ are the most exposed parts of the jaw. The books say they do not fuse until well into the first year. I suspect that they are not firmly united to the superior maxillæ until the third or fourth year. As will appear in the discussion of the second part of the paper the premaxillæ at the start are mere shells of bone, and do not acquire any considerable solidity until the second incisors are well on their way to full eruption.

In addition, as you know, the crowns of the second incisors fill the body of the premaxillæ to bursting, and are so slightly covered that they are readily accessible to trauma applied within the anterior part of the mouth. The palatal surfaces of the premaxillæ are further weakened by large openings for the gubernaculæ. Beside the mild form of trauma represented by thumb-sucking there are the innumerable bumps of early childhood upon the nose and upon the anterior teeth to injure the sacs of the second incisors, and so interfere with the proper growth of the premaxillæ.

The Premaxillæ in Man.

The existence of the premaxillæ in man is obscured even at birth, except on the surface of the palate by anchylosis, and masked by the extension over them of a delicate plate of the maxillary bone. This plate, which hides the premaxillæ, is wanting in all other animals. In apes the maxillo-premaxillary suture is for a long time or permanently evident on the face.

The two premaxillary bones form the sockets for the upper incisor teeth. In the human fetus at birth the suture between the maxilla and the premaxilla can be seen on the hard palate (Fig. 8). It runs diagonally forward and outward from the anterior palatine fossa to the alveolus between the lateral incisor and the canine tooth. On the facial aspect the

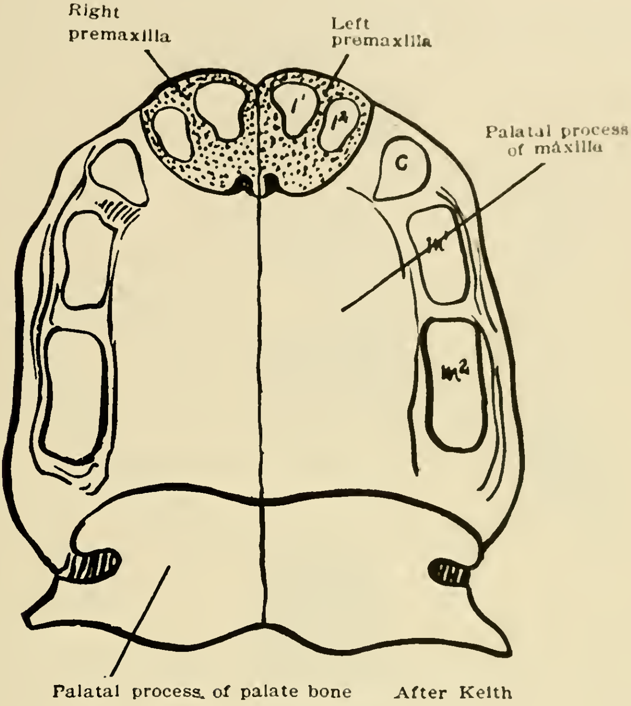


Fig. 8.

The hard palate at birth. The premaxillary part is formed from the mesial nasal processes. The remainder by the palatal processes of the superior maxillæ and of the palate bones.

premaxillæ fuse with the superior maxillæ in the third month of fetal life, the maxillæ overlapping and almost completely excluding them from the face.

In man each premaxilla is usually ossified from two centers placed side by side. The two premaxillæ unite in the first year after birth. Their vestigal character in man is due to the small size of his masticatory apparatus and the consequent retrogression in the development of the facial part of his skull. (Keith, pp. 3-5.)

Each premaxilla is an oval shell of bone, all the faces of which are very thin. The body of the bone is completely filled with the crowns of the incisor teeth and accurately takes its form from them (Fig. 9). Projecting horizontally forward from the anterior edge of the upper face of the premaxilla is a pointed process called the nasal spine. The superior surface of this is slightly concave. Also projecting from the upper face of the premaxilla in the middle line, but projecting obliquely upward and outward, is another process, the premaxillary wing. This process extends along the posterior two-thirds of the superior face of the premaxilla. Its upper surface is markedly concave. The inner edge of the base of this process is irregularly undermined so that it can mortice into the corresponding process of the other premaxilla. The upper edge of the wing slopes outward and the root of the wing on its outer side is

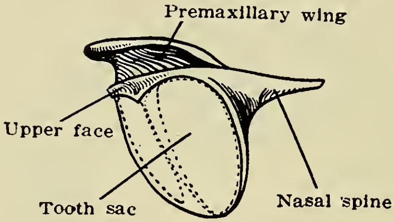


Fig. 1. Side view.

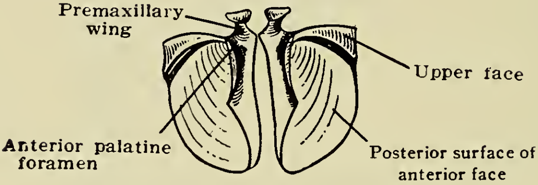


Fig. 2. View from behind.

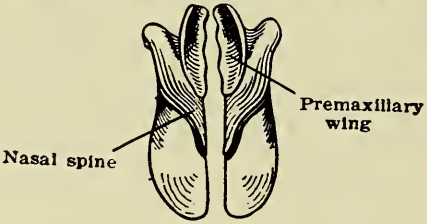


Fig 3. Premaxilla seen from above.

FIG. 9.

The premaxilla at birth.

constricted by a smooth gutter, as if for the passage of a vessel or a nerve. Owing to this the wing has a narrow constricted base and a concave flaring surperior surface. When the two premaxillary wings are placed together their bases fit into one another so that the wings form a sizable gutter. Into this, in the complete septum, fits the tip of the vomer, also a gutter. The premaxillary wings act as cleats on either side of the tip of the vomer to hold it in place. Their position controls the position of the vomer.

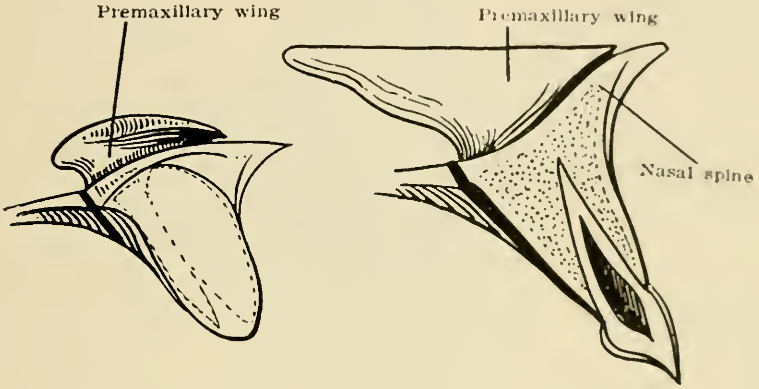


Fig. 10.

Fig. 1. Premaxilla at birth. Fig 2. The premaxilla in the adult.

From birth up to six years of age the premaxillary wings increase in size but little. From this time on, however, they enlarge rapidly, so that in the adult each wing measures about half an inch along its upper border, and is a quarter of an inch in height (Fig. 10). The premaxillary wing grows especially upward and backward, so that its final form is triangular. The apex of the triangular piece of bone which constitutes the premaxillary wing points downward and rests just in front of the anterior palatine fossa. This process undergoes a greater proportional growth than almost any other part of the septum. This is necessary in order that the premaxillary wings should not lose control of the vomer.

The premaxillary wings are said to fuse with the tip of the vomer at fifteen years of age. On account of their position and on account of this fusion with the vomer, the two processes have usually been known as the sub-vomer bones. Dissection has led me to consider them not as separate bones, but as processes of the premaxillæ the same as the nasal spines. At birth the premaxillary wing is firmly united to the superior face of the premaxilla by a slender neck and apparently is a part of it. For this reason I call this process the premaxillary wing.

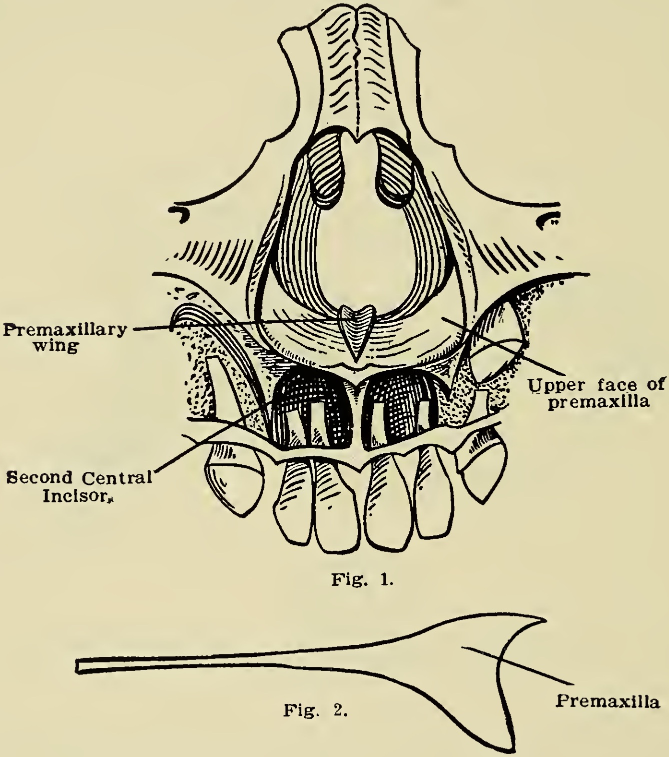


Fig. 1.

Fig. 2.

FIG. 11.

Fig. 1. Dissected alveolus of a child three years old. The upper face of the premaxilla is flat and fits accurately over the top of the second incisor.

Fig. 2. Shows that the upper face of the premaxilla is almost flat.

The Changes in the Premaxillæ as the Incisor Teeth Erupt.

As the antra enlarge and descend with the eruption of the second teeth the crest of the palate bone and the crest of the superior maxilla grow upward (Fig. 13). At the same time the nasal spines and the premaxillary wings also grow in the same direction. Heretofore the superior face of the premaxilla has been flat like a plateau. This plateau now disappears and the superior face slopes downward and backward at an angle of forty-five degrees. For this the upward growth of the nasal spine is in great measure responsible. The nasal spine in the adult makes a bony rim about the vestibule and turns the incisor plateau of infancy into a moat.

The fact that the inclination of the superior face of the premaxilla depends upon the teeth below it and changes as these erupt is shown prettily by dissections. At birth the upper rim of the hollow crown of the middle incisor fits snugly under the thin upper face of the premaxilla. The upper rim of the crown is flat, and so also is the superior face of the premaxilla which is paper-like in thickness and roofs it over. This is shown in Fig. 11, which is drawn from the dissected alveolus of a three-year-old child. As the flat rim of the upper part of the hollow crown gives place to the pointed root, the superior face of the premaxilla changes from a plateau to a slanting surface. The form of the nasal notch changes in the meantime from a triangular aperture to a heart-shaped opening. Normally, therefore, the line of the superior face of the premaxilla and the shape of the nasal notch are determined by the degree of eruption of the incisor teeth. Fig. 12 represents the superior maxilla and the corresponding premaxilla at six years. In this specimen the upper rim of the crown of the central incisor is flush with the under surface of the superior face of the premaxilla, and occupies the greater part of it. The layer of bone over the tooth crown is still paper-thin, whereas the amount of bone over the lateral incisor is much greater. The lateral incisor could have but little influence compared with the central incisor upon the form of the superior face of the premaxilla and upon the premaxillary wing (Fig. 12). All parts of the alveolus except that part

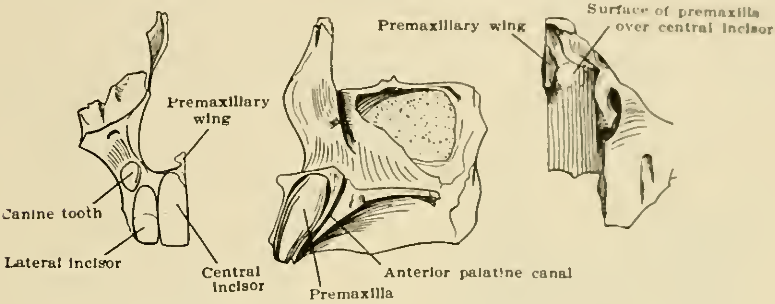


Fig. 1. Fig. 2. Fig. 3.

FIG. 12.

The premaxilla and the superior maxilla from a child of six.

made by the premaxillæ are buttressed by the walls of the antrum (Fig. 13). The superior face of the premaxilla is free in the nose and not so buttressed. The form of this, therefore, can be readily altered.

If the normal eruption of the incisor teeth causes a change in the upper face of the premaxilla the question is at once suggested: Does delayed or irregular eruption of the incisor teeth cause a still further change, a change which is of any significance in the pathology of the septum? It does.

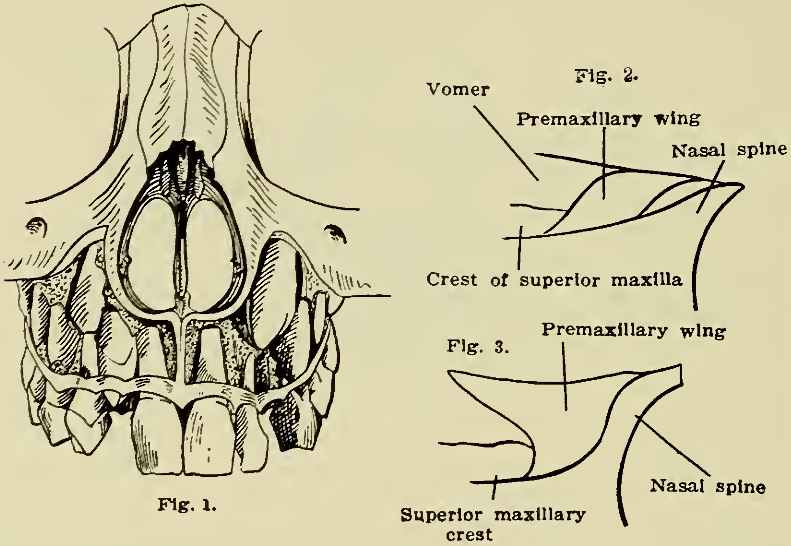


FIG. 13.

Fig. 1. Dissected alveolus of a child eight years old. The nasal notch has lost its former triangular shape.

Fig. 2. The upper face of the premaxilla. The nasal spine and the premaxillary wing are beginning to grow upward.

Fig. 3. The nasal spine and the premaxilla have their adult growth.

In order to understand how this may take place it is necessary to review the anatomy of the septum.

The Septum at Birth.

The septum at birth is almost all cartilage (Fig. 15). The only bony parts are the vomer and the two premaxillæ and their processes. The vomer has a very characteristic form. It consists of two leaves of thin bone, which are united below, but are open and flaring above (Fig. 16). This formation is a relic of its double origin, evidences of which the vomer never entirely loses. The premaxillary wings make the vomer over again in miniature. That is, they also form a V, or gutter.

The premaxillary wings spring from the posterior half of the upper face of the premaxillæ. In the groove which they form rests the tip of the vomer. Two other processses spring from the superior surface of the premaxillæ, one from each, namely the nasal spines. These again make a slight gutter, into which in its turn fits the tip of the premaxillary wings. The tip of the vomer rests in the gutter of the premaxillary wings, and the tip of the premaxillary wings rests in the gutter of nasal spines, like the arrangement of the sections of the old-fashioned V-shaped wooden drain (Fig. 17).

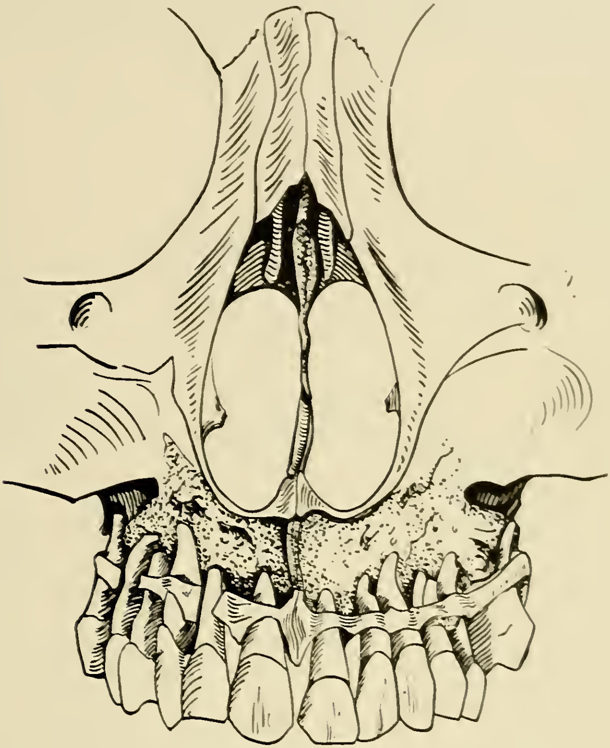
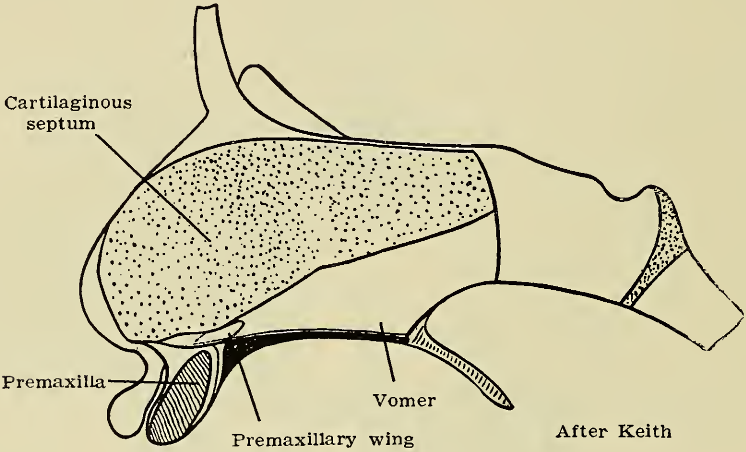


FIG. 14.

Dissected alveolus of an adult. The nasal notches have the adult heart-shaped form. (See Figs. 13, 3.)

The Adult Septum.

The upper border of the adult vomer is gutter-shaped like the vomer at birth, the gutter not being so deep (Fig. 18). It is surprising how long the vomer retains this characteristic to a very marked degree. At four years of age the vomer still consists of two leaves for half its height. In the adult septum the lower border of the perpendicular plate of the ethmoid is gutter-shaped the same as the upper border of the vomer, with which it articulates. Between these two bones, therefore, there is a lozenge-like space filled with cartilage. The strip of cartilage which fills this space is an offshoot from the posterior inferior angle of the quadrangular cartilage. It runs backward and upward in the space left for it, at times reaching the front wall of the sphenoid. This is called the caudal prolongation. There are other peculiarities of the adult septum which have a bearing upon the subject of this paper. They may be grouped as follows: The lower part of the quadrangular cartilage just above the premaxillary wings is very thin, whereas the upper part in line with the middle turbinate is thickened into what is called the tubercle. After eight years of age the growth of the quadrangular cartilage occurs chiefly at a center of growth just above the premaxillary wings. There is a second less important center half way up its posterior border. At birth neither the palate bones nor the superior maxillæ rise into a crest for the support of the lower edge of the septum (see Fig. 15). In the adult, on the other hand, both of these bones have marked crests. These grow upward while the rest of the septum is growing downward, affording at times a factor in disturbing the equilibrium of the mosaic of the septum. This factor is not generally considered.

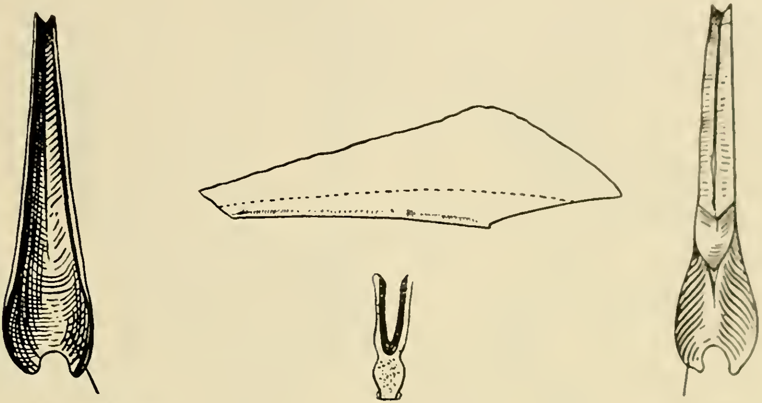


After Keith

FIG. 15.

The septum at birth.

It has usually been held that the weakest part of the septum is the articulation between the upper border of the vomer and the lower edge of the perpendicular plate of the ethmoid. From the description of the septum which has just been given it is easy to see why this is so. There is, however, another part of the septum which is even weaker. This place is at the tip of the vomer, or the region of the premaxillary wings. Here the mosaic of the septum is the smallest, here the tip of the vomer lies in the groove of the premaxillary wings, here the caudal prolongation of the quadrangular cartilage starts, here the quadrangular cartilage is the thinnest, here is placed the remnant of the organ of Jacobson, and here the quadrangular cartilage has its chief center of growth. Anatomically, therefore, this part of the septum is especially fitted to be the starting point of spurs and deviations. If for any reason the equilibrium of the septum is upset one would expect it to show itself first at this point.



From above

From below

Fig. 16.

The vomer at birth, showing the two leaves and the gutter made by them.

The Condition of the Septum in Forty Cases of Delayed Dentition.

If the normal eruption of the incisor teeth causes a change in the upper face of the premaxilla the question is at once suggested: Does delayed or irregular eruption of the incisor teeth cause a still further change, a change which is of any significance in the pathology of the septum? It does. I asked and answered this question some pages back. The reasons for my answer I will now give. Within the last month I have collected forty cases of irregular and delayed eruption of the incisor teeth.* The patients were mostly children who came to the clinic to have their tonsils and adenoids removed. The ages of the majority were between seven years and twelve. Five of the cases were adults. Through the kindness of Dr. L. B. LeGro, of Haverhill, I had the opportunity to examine four cases from his private practice where the history of the teeth was known from the beginning, and where the teeth had been carefully watched and cared for. Since every point in connection with these cases could be followed I will give the cases in detail.

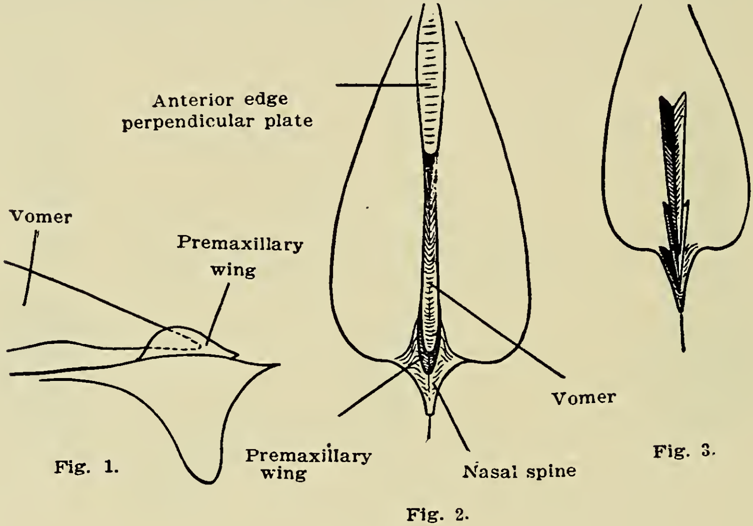


FIG. 17.

Fig. 3 is a diagrammatic drawing showing how the vomer lies in the gutter made by the premaxillary wings, and the premaxillary wings lie in the gutter made by the nasal spines.

T. B., Female, 8 Years.

The eruption of the incisors occurred six months ahead of time. The right middle incisor is fully down and in good line. The left middle incisor is just appearing through the gum. Both first lateral incisors have been lost and neither second lateral incisor is showing.

Nasal Examination.

The wing of the premaxilla on the side of the left central incisor, the delayed incisor, is enlarged. There is a left vomer spur running back from this for one-half inch. The right premaxillary wing is not enlarged. The septum deviates moderately to the right, for three-quarters of an inch backward.

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*This was written about two years ago, since that time I have seen in all over a hundred cases.

The arch of the palate is moderately high. Both halves of the arch are of equal height. There is no nasal obstruction. The tonsils and the adenoids were removed three years ago. There are practically no tonsils.

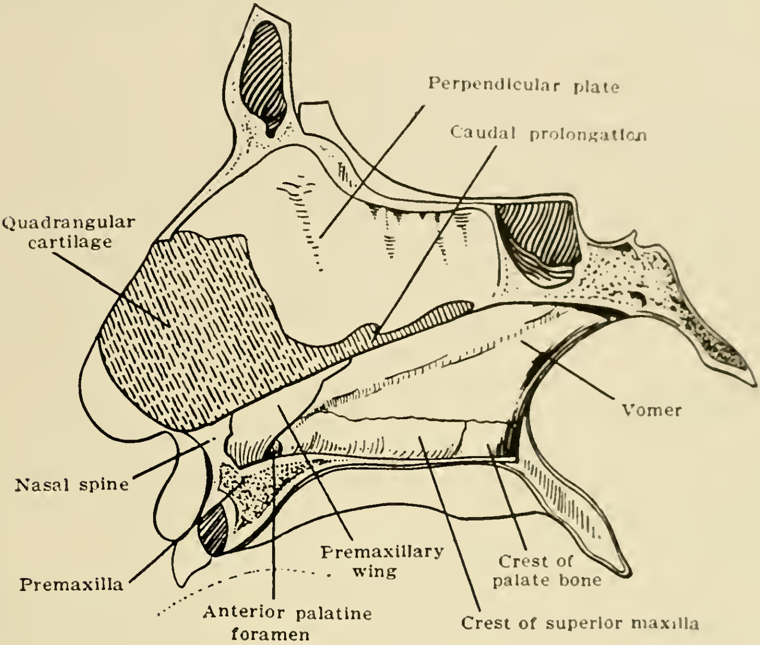

FIG. 18.

The adult septum.

G., Male, 8½ Years.

Both central incisors are fully erupted and in perfect line, at the present time, but the patient's history card states that the left middle incisor came down six months after the right middle incisor, and six months after the normal time of eruption. The arch of the palate is normal, and both halves are of equal height.

Nasal Examination.

There is a slight vomer spur on the left, and a slight deviation of the septum to the right, beginning about a third of the way up on the septum and running one-half inch backward. There is a slight vomer spur on the right. There is no nasal obstruction. The tonsils and the adenoids were removed three years ago. There are practically no tonsils to be seen.

M., Female, 18 Years.

The left incisors and the left canine were delayed in eruption, and were irregular and crowded. Much regulating has been done to the teeth, and the first bicuspid has been removed in order to allow the teeth in front to come into line.

Nasal Examination.

The premaxillary wing on the left is slightly enlarged with a slight deviation of the septum into the right side. The axis of the deviation is horizontal. There is moderate enlargement of the wing of the premaxilla on the right running backward one-half inch. Half way back on the vomer-ethmoid junction there is a small sharp spur. The arch of the palate is normal, and both halves are of equal height. There is slight chronic rhinitis, and a moderate granular pharyngitis.

M., Male, 9 Years.

All the upper incisors of the first dentition are still in place. Normally these should have fallen out two years ago. The incisor teeth are regular in outline, but are movable on pressure as if they were on the point of being cast off. The nasal bones are in good line. There is no history of trauma, and there is no nasal obstruction. The arch of the palate is normal and both halves are of equal height.

Nasal Examination.

There is a large vomer spur on the left, running well back. The left premaxillary wing is much enlarged, the right premaxillary wing slightly enlarged. The septum deviates into the right nostril. The axis of the deviation is horizontal.

These four cases are from families in good circumstances, so that the teeth have had every care. In all, the line of the nasal bones was straight. In all, strict questioning of the parents brought out no history of trauma. In the first three cases there was moderate delay and irregularity in the eruption of the incisor teeth. In these examination showed an enlargement of the premaxillary wing on the side of the delayed tooth and a slight deviation of the anterior part of the septum. In the fourth case the first incisor teeth were retained two years beyond the time when they should be shed normally. In this case there was a very large premaxillary wing on one side with a large vomer spur running well backward from it, a moderate enlargement of the other, and in addition there was a deviation of the septum into the opposite side. So marked was the deviation that any increase from continued growth along the present vicious lines or any sudden increase from trauma must produce obstruction.

The case of the girl of eighteen is of especial interest, because she started with delayed and crowded teeth. Her teeth were carefully regulated, however, and brought into line so that her septum escaped with but slight deformity. The lesson of such a case is obvious. At the time that I saw the second of these four cases both central incisors were equally and fully erupted and in good line, but the history card showed that the left middle incisor came down six months after the right middle incisor and six months delayed. In the nose, on the side of the lagging incisor, examination showed that the premaxillary wing was enlarged and that there was a small vomer spur on the same side. The septum deviated slightly to the right. From these cases it is seen that the history of the eruption of the incisor teeth is to be read in the nose.

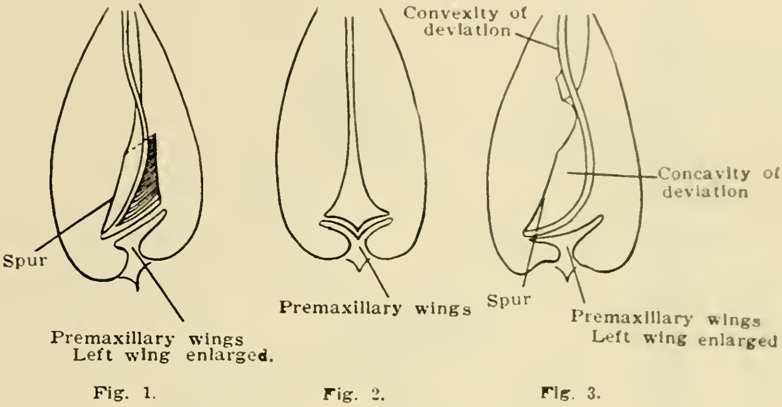

FIG. 19.

Diagrammatic drawings of the types of deviation due to deformity of the premaxillary wings.

Fig. 2. Both premaxillary wings turned outward, causing a double basal spur of the septum.

The results of the findings in the rest of the forty cases can be put very briefly. They are as follows: Wherever there was moderate and equal delay in the eruption of the central incisors the premaxillary wings were symmetrically enlarged at the floor of the nose on both sides. In such cases there was usually little if any deviation of the septum, and there was no vomer spur. Where, however, there was marked inequality and delay in the eruption of one central incisor as compared with the other, on the side of the backward tooth the premaxillary wing was much enlarged or displaced, and the quadrangular cartilage tipped out of its bed along the vomer ethmoid suture. As a rule the long axis of the deviation was antero-posterior, roughly paralleling the spur, and the upper part of the cartilage was bowed toward the spur. Accompanying this horiontzal deviation there was often a certain amount of sigmoid

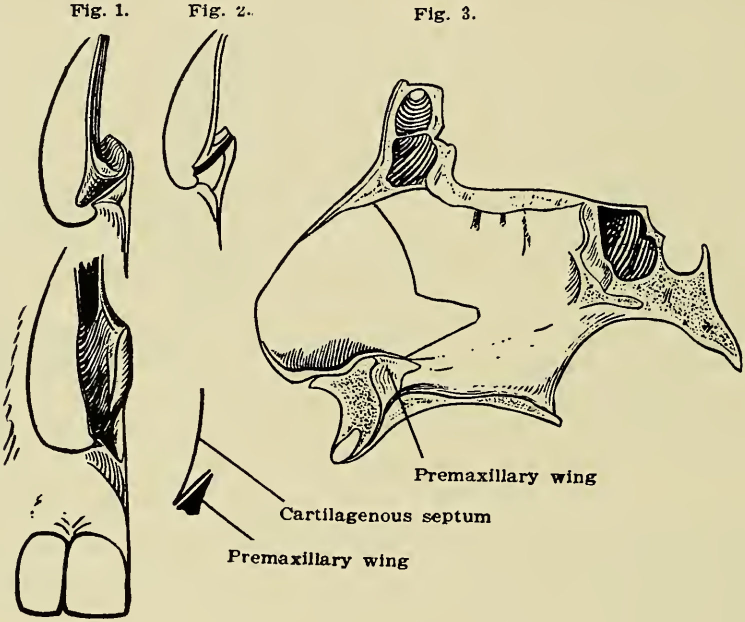

Fig. 20.

Specimen of a deviation of the septum due to an enlarged left premaxillary wing.

Fig. 1. Dissection of the groove of the premaxillary wings. Left wing enlarged.

Fig. 2. Scheme of the deviation.

deviation, the axis of which was vertical. It is fairly common to find the root of the lateral incisor rising like a mound into the outer part of the floor of the nose. Even when the lateral incisors are crowded out of the dental curve and are placed directly behind the central incisors, a deformity which is striking and one from which you naturally expect much at first glance, they seem to have but little influence on the septum, compared with the central incisors.

The Anatomical Finding in Dissected Specimens.

The findings of these forty clinical cases are borne out and the details of their formation explained, by the dissection of twelve cases in which an enlarged or displaced premaxillary wing caused a deviation of the septum. These dissecting-room specimens show that if the pressure caused by the premaxillary wing is applied to the septum directly in its vertical axis, the lower edge of the cartilage stays in its bed, whereas the lower part folds sharply upon itself, the axis of the fold paralleling the upper border of the vomer (Fig. 19). More often, however, the force seems to be applied a little to one side of the vertical axis of the septum. When this happens, the lower rim of the cartilage is forced out of the groove between the retaining premaxillary wings and also out of the groove between the two leaves of the vomer, and curls upward and outward. As it does this it breaks off one premaxillary wing or stunts its growth and does the same thing to the corresponding leaf of the vomer. This results in the formation of the familiar spur along the vomer

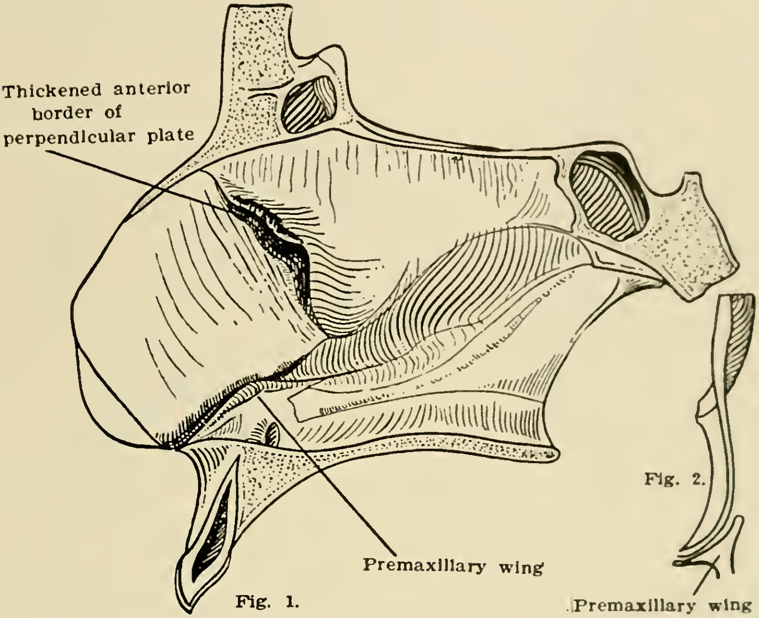

FIG. 21.

Fig. 1. Deviation due to enlargement of the premaxillary wing.
Fig. 2. Dissection of the deviation.

ethmoid articulation (Fig. 20). The concavity of the lower portion of the cartilage about half way up the septum merges into a compensatory convexity. These dissected specimens bear out the clinical findings that the convexity generally is toward the spur and away from the enlarged premaxillary wing (Fig. 21). Occasionally, however, the reverse of this is found. The spur, as a rule, is on the side of the convexity and seems to crown it. The enlarged premaxillary wing is found in the dissected specimens to make an anterior basal spur which runs from a quarter of an inch to an inch backward. Further, the dissected specimens show that when the two premaxillary wings are enlarged but slightly, and are enlarged equally, they often tip outward and make a small anterior basal spur on either side of the septum. Where, however, both premaxillary wings are evenly enlarged to a considerable extent, and the pressure caused by this enlargement is not equalized by their turning outward, as in the case just described, the tip of the septum is first pushed upward and then to one side (Fig. 22). The septum in this case yields instead of the premaxillary wings. I found this condition in the skull of a three-year-old child.

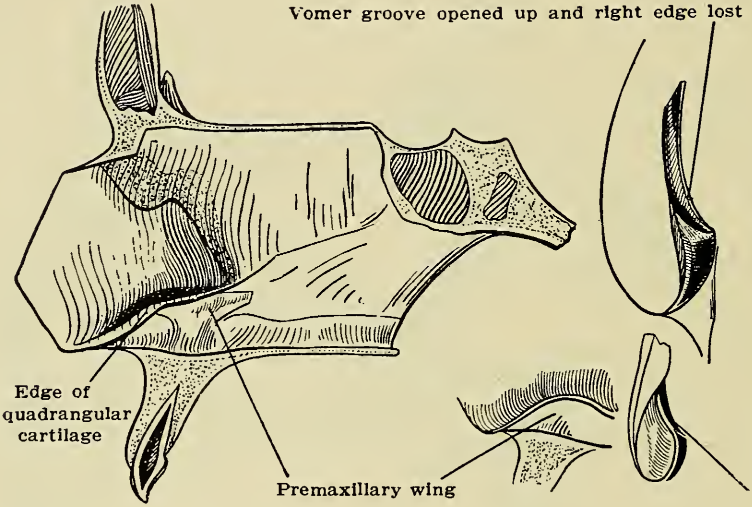
Vomer groove opened up and right edge lost
Edge of quadrangular cartilage
Premaxillary wing

FIG. 22.

Deviation of the septum due to the enlargement of the premaxillary wing. Small figures, the dissected anatomy of the deviation.

It should be borne in mind, however, that the nasal spine is the cause of deviations in certain cases. In the cleaned skull the nasal notch on the side of the enlarged premaxillary wing is higher than the notch of the other side. The X-ray will demonstrate this in the living.

I feel that good anatomical and clinical evidence has been given to show that enlargement of the premaxillary wings, the enlargement being due to delayed eruption of the incisor teeth, must be considered as an important cause of deviations of the septum.

Treatment.

That there is a relationship between the teeth and the nose has been known for many years. Zuckerkandl at least fifteen years ago, and Potiquet ten years ago, drew attention to the fact that irregularity in the eruption of the incisor teeth could deform the septum. Since Potiquet the observation has lain dormant. I found his observation quoted in the "Anatomy of the Nasal Fossæ" of Sieur and Jacob, and tried to substantiate it for myself. I have just given you the result of my work. For me it is settled that the incisor teeth can deform the septum. The great practical question at once arises: "What can be done in order to prevent this?" The answer is found in the following fact: Wherever the central incisor teeth are well spaced and have erupted normally, and the halves of the palate are of equal height, examination will show that the septum is almost always straight. By appropriate treatment it is maintained that the normal eruption and spacing of the incisor teeth can be secured. By accomplishing this the dentist can save many a septum from deformity. Not only should normal eruption, spacing and occlusion of the incisors be sought, but the other teeth should be made normal in these three respects. This is important because the second great cause of the deviation of the septum is inequality between the two sides of the palate. and this is due in nearly fifty per cent. of the cases to the teeth. When it is not due to the teeth it is caused by asymmetry between the two halves of the head as a whole. Two of the three chief causes of deviation of the septum, therefore, can be prevented by dealing with the teeth.

The treatment of deviations brings up another practical question which is in the minds of all. This is, "How much can the septum be saved from deformity by widening the arch of the palate, and by so doing widening the nasal fossæ?" It is not new knowledge to the dentist that the nasal fossæ can be widened by widening the arch of the palate, but it is new knowledge to many physicians, even to many specialists. It is easy to see how the old, cumbersome and uncomfortable split plate could widen the arch of the palate and at the same time widen the nasal fossæ, but it is not so easy for the lay physician to see how some of the modern methods are always sure to accomplish more than a change in the angle of the teeth and of the alveolus, and so an apparent, not a real, widening of the palatal arch. I know, however, from discussions which I have nad with dental practitioners, that the arch is really widened by the beautiful mechanical appliances employed to-day, yet I feel that a certain amount of exact data about their working is still to be accumulated. Granted that the width of the nasal fossæ can be increased by widening the palatal arch, the vital question remains, "How much?" Before this can be answered, the normal growth of the palate for any given year must be known. Likewise, the normal width and the normal increase of the width of the nasal fossæ must be ascertained. As the subejct stands to-day, the man who widens an arch adds the widening due to growth to the widening due to his apparatus and credits his appliances with both. This may be natural, but it is not exact. The information which I ask for can be obtained only by the cooperation of the nasal specialist and the dental specialist. I know that such work is already in progress. We shall all welcome the day when it is completed and the loose statements of the past are replaced by accurate ones. When this knowledge is in our possession we can say definitely how much the septum can be straightened by widening the arch of the palate. I believe that much good can be accomplished in this manner. I think that it will be found that what is accomplished is due more to the widening of the nasal fossæ, and to the consequent relief of obstruction, than to actual correction of the deviation. Frankly, I do not see how a deviation can be made straighter by this means. All that can be accomplished is to prevent its further increase. This, of course, is not to be considered unimportant. Before we can hope to obtain the exact information which, more than anything else, is to settle the question which I have just been discussing a considerable space of time must elapse. The obvious thing to do in the meantime is to correct every case of malocclusion, to widen every narrow arch, and bring it as nearly to the normal form as possible, and, above all, if you will permit me to say it, to guard the premaxilla from injury, and in every known way to strive to bring about the normal eruption, spacing and occlusion of the central incisor teeth.

Summary.

The premaxillæ exert a very marked influence upon the form of the hard palate. In order to have a normally formed palate two changes must take place in the premaxillæ, they must shrink in size to the proper degree, and they must turn downward sufficiently. Failure of both changes to occur results in the negro type of palate; a proper readjustment of position, but a failure of shrinkage, results in a high arch. The premaxillæ exert an influence not only upon the form of the hard palate, but also upon the line of the septum. I have been working upon the influence of the teeth upon the septum for the last year and a half. In this time I have seen over a hundred cases where the relationship between the teeth and irregularities of the form of the septum was demonstrable. My observations are readily summarized as follows: There are three great causes of deviations of the septum: trauma, irregularity in the eruption of the central incisor teeth, and inequality in the descent of the two halves of the palate. In nearly half of the cases where there is inequality between the halves of the palate the teeth are responsible. Therefore, it might be said that there are but two great causes of deviations of the septum, trauma and some irregularity in the development and eruption of the teeth. Delayed eruption of the teeth is caused in great measure by some disturbance of nutrition. When the eruption of one central incisor is sufficiently delayed it causes a deformity or hypertrophy of the premaxillary wing above it. This distorts the retaining groove made by the premaxillary wings. As a result, the septum slips from its bed in the vomer, and the groove made by the two leaves of the vomer spreads open, one leaf or side of the V disappearing. This produces a spur along the upper edge of the vomer. As the cartilaginous part of the septum slips from its bed the lower edge curls upward and outward, so that the lower portion becomes concave. Higher up on the septum this concavity gives place to a compensatory convexity. The convexity is generally toward the spur. On the side of the delayed tooth a short basal spur indicates the enlarged premaxillary wing. Deformity of the septum is often caused by asymmetry of the halves of the palate. This asymmetry shows in the nasal notches anteriorly and in the choanæ posteriorly and in the mouth. Such extensive asymmetry is due to unequal descent of the antra. Wherever the central incisor teeth are found to be well spaced (and by well spaced I mean neither too much nor too little space between the incisors), and the two halves of the palate are of equal height, the septum is almost always straight. By ensuring the proper eruption and spacing of the incisor teeth the septum can be saved from deformity. Normally erupted and spaced teeth, I am speaking now of all the teeth, mean, in a great majority of instances, a straight septum. After the teeth are fully erupted and in good line there remains no evidence of their delayed eruption except in the nose. Trauma, as well as delayed eruption of the incisor teeth, can displace the premaxillary wings and distort the vomer groove, resulting in spurs and causing deviations anteriorly and posteriorly. The best explanation for the slight anterior deviations which are so constantly found is some fault in the eruption of the incisor teeth. Abundant dissecting-room findings prove that deviations so started may extend far backward on the septum and become obstructive.

Discussion of Paper by Dr. Mosher.

F. A. Faught, M.D., Philadelphia.

Mr. President and Members of the Society: I think you will agree with me that a paper which is practically composed of pioneer work, hardly admits of discussion.

I believe that the point of the paper, reduced to a few words, is this: At last we have found the origin of probably the majority of deviations of the septum; at least those slight ones occurring in the anterior part, chiefly in the cartilage. It is also interesting to observe that in this keynote was contained the sequel to an investigation of two and a half years, and reported in part by me to the Section of Stomatology of the American Medical Association a year or two ago.

Dr. Mosher has first begun by clinically demonstrating the relation between the abnormal eruption of the central incisor and the premaxilla as it affects the position and normal straightness of the septum. Then he demonstrated anatomically that the changes he believes to be present do occur and produce the conditions of which he speaks. If we could now prevent the normal eruption of the central incisors and see the effect, our proof of this proposition would be absolutely conclusive.

Someone very recently, I believe Dr. Douglass, suggested the relation between the nasal spine, the wings of the premaxilla, and deformities of the septum. It took Dr. Mosher to determine the rest, and prove it. Dr. Mosher gives a complete demonstration of how the irregularity acts. An abnormal enlargement of one of the wings of the premaxilla is caused: the groove is destroyed and a sliding out and increased growth of the cartilaginous portion of the septum follows.

One question occurs to me: What is the relation of rickets in young children to septal deviations? Is the delayed eruption of the central incisors a part of the same process? We have enlargements of cartilage throughout the body in rickets: enlargement of the epiphyses of the long bones, etc. It seems that part of this enlargement may be due to a similar overgrowth of the cartilage of the septum. Up to the present time rhinologists have considered the correction and prevention of nasal deformities entirely in their province, but it seems to me that this will now have to be relegated to a great extent to the orthodontist. He has power to correct and prevent further deformity, and also by determining the delayed eruption of the teeth and stimulating vital function, should be able to prevent the occurrence of septal deformity in many cases.

As to the separation of the intermaxillary suture, at a dental meeting in Philadelphia last spring, Dr. G. V. I. Brown demonstrated a method of spreading the two halves of the maxilla. His demonstration was perfect, but it did not take into consideration the trauma and pain attached to such work in children over seven or eight years of age. Dr. Mosher asks, "Granting the separation can be accomplished, the vital question remains, How much?" The conditions requisite for a trustworthy answer he has just stated, in words similar to my own, which I uttered more than a year ago, in discussing this same question.*

It may not be out of place to abstract from this article here. In closing I said:†

"In considering the effect of expansion methods on deviations of the nasal septum, it does not seem to be definitely recognized that these are really irregularities of only a part of this structure. They usually involve only the cartilaginous portion, and even when the bony part is included in the deflection, this rarely extends throughout the entire width of the bone. This fact has an important bearing on the success of this operation, as advocated by a number of practitioners at this time."

* * * * * * * *

"Expansion is believed by many to lower the floor of the nose, and, in so doing, to relieve pressure and exert a downward tractive force on the deflected septum. In view of the above facts, it seems almost unnecessary to state that, even if the direction of such a force were possible, it would be effective only in the rare event of a simple complete deflection. For if a part of the septum be already straight, as it usually is, this will effectually resist any straightening force which might reach it through the alveolar and palate processes."

* * * * * * * *

"To close this consideration of the subject at this juncture would undoubtedly leave the erroneous impression that most efforts to influence upper respiratory obstruction and mouth breathing favorably, through corrective measures applied to the teeth and dental arches, are of little, if any, value. This would be the logical conclusion if the process were a purely mechanical one. On the contrary, we are dealing with vital tissues, possessing each a special function and capable of growth, repair and atrophy.

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*Read in the Section on Stomatology of the American Medical Association at the Fifty-eighth Annual Session, June, 1907.

†From *The Journal of the American Medical Association*, January 18, 1908, Vol. L, pp. 172-175.

"It is a well-known physiologic fact that one of the most powerful stimuli to the proper development and normal function of any tissue or part, is the exercise of the specific function for which that tissue or part is intended."

* * * * * * * *

"Conversely, the inability properly to perform this function invariably results in either imperfect development or wasting and atrophy.

"It is natural then that we should find various alterations in the structure of parts of the whole upper respiratory tract. Thus may we account for the effect of adenoids, malocclusion, short-lip and tonsillar hypertrophy on normal nasal respiration and the production of the inevitable train of disturbances accompanying imperfect development of the bones of the face, particularly the maxilla and those forming the nasal passages.

"This also explains why the removal of exciting causes and the correction of existing deformities of contiguous parts gradually brings about a resumption of growth in these tissues, resulting in the production of normal nasal chambers and the return of norml nasal respiration.

"Possibly of equal importance in contributing to improvement after most corrective measures, is cell stimulation and renewed growth in the maxillary bones, through the irritation caused by the varying degrees of pressure applied to the teeth and alveolar arches. The extent to which this process may be operative is a matter not easily determined, and how far these two factors influence the conditions in a given case to the exclusion of others, we are, as yet, unable to determine, since up to the present time no practical or sufficiently accurate methods of observing and recording these changes have been devised.

"Without doubt, many of the results which have been attributed solely to the effect of definite movement of bone, and the resulting improvement in the respiratory capacity of the nasal chambers, are in reality instances of the beneficial results of stimulation of these vital functions."

Gentlemen, members of the American Society of Orthodontists, it remains with you to determine what the normal form and size of these parts at any given age are, and to devise, if possible, an accurate and practical method of measuring and recording the normal and abnormal in this region. By so doing you will furnish the necessary complement to Dr. Mosher's work, by reducing the study and treatment of orthodontic conditions to a truly scientific and accurate basis.

Dr. Matthew Cryer, Philadelphia.

Dr. Mosher has spoken of the matter of the relation of the teeth and nose as though it had been but recently noted, but Harrison Allen thirty-five years ago wrote on this subject, and in his lectures in the Philadelphia Dental College in 1873, '74 and '75 he taught that in order to understand the correction of irregularities of the teeth you must understand the nasal chamber: to treat the nasal chamber you must know the occlusion of the teeth, etc.

The doctor has spoken with regard to the expansion of the arch by mechanical means. Now, since I read a paper some years ago on the "Occlusion of the Teeth," I have been a little afraid to give my ideas before this society. I will say this as an assertion: You can not spread the width of the floor of the nose by the expansion of the walls of the mouth; also, that you can not expand the arch of the mouth by expanding the teeth separately from one another. Take the dome of this arch and spread the walls out and you will not spread the roof, providing it has a proper suture. You may move the teeth apart, but you will never widen the maxillary bones.

Dr. Rogers, Boston.

There are one or two ideas I want to emphasize. Dr. Mosher has opened before us what is practically a new volume for observation. I had the pleasure of traveling last night with the doctor, and in our conversation I could see where our work overlapped, and that there were many possibilities of future development. We can see clearly where we stand at the present time, but the progress we shall make in the future is to me inconceivable. The relationship is so intimate between the teeth, the dental arches and the nasal cavities. If we can scientifically comprehend these things, and by the proper treatment of the temporary arches be able to prevent these deflections of the septum, as well as prevent nasal spurs, we will be doing a wonderful work. This paper is destined to be one of the factors to stimulate us to greater effort.

A great deal of the anatomy which Dr. Mosher has brought before us is new and hard to understand on this its first presentation, but to study this is our duty; we must in the very near future make ourselves proficient in a knowledge of this anatomy, for without it we can not expect to be successful in our work. Let us make ourselves absolutely proficient in the minute details of the anatomy of the parts surrounding the teeth.

Dr. Ottolengui.

I will just say a few words on one particular phase of the subject. I need not say that I consider this a very fine and helpful paper, but I only wish to discuss the last part of it, which deals with treatment. The essayist raised a question as to whether or not we can help the nasal passages by methods of widening the arches. Dr. Faught spoke of some method of Dr. G. V. I. Brown, wherein he spread the maxilla apart by opening the suture, and Dr. Cryer tells us that we can not widen any portion of the dome by traction on the teeth. I agree absolutely with that dogmatic statement of Dr. Cryer's; also, I believe that you can not lower the vault by widening the arch of the teeth, because of the anatomy of the region above. Nevertheless, in young patients the maxillæ can be spread apart along the line of the suture. The suture can be opened, and very quickly—within three weeks—and it is not painful, contrary to Dr. Faught's supposition. I have done it many times without soreness in that particular part of the mouth. I was under the impression when I read a paper at the St. Louis congress, that this opening of the suture could not be accomplished with the expansion arch. I have since discovered, by actual experience, that the suture can be opened with the expansion arch. It is merely a question of the manner in which traction is applied. But considering the ease with which the teeth themselves may be moved, and that you would need to have more resistance in the tooth alveoli than along the median line, I believe, where there is nasal stenosis, it would be better not to make the attempt with the expansion arch, but to apply force high up in the mouth with the split plate, and open the suture in that manner. There are gentlemen present who practically know that, following orthodontic interference, there has been an increased nasal capacity. How can we make that agree with the statement just made? I believe we should not forget, in studying skeletons, that in life we are dealing with subjects where these bones are covered with soft tissues, and the cavities we are looking at are much smaller, in life, and that these soft tissues are subject to disease. Where there is mouth-breathing we are likely to have nasal stenosis, contributed to by a thickening of the membrane covering the bones. Orthodontic interference, by overcoming mouth-breathing, aerates the cavities and restores the tissues to normal; thus you have increased breathing space by reduction of the thickness of the soft tissues.

Dr. Wilbur Dailey, New York.

This subject, as Dr. Mosher has presented it to your consideration, has been prominent in my mind for a number of years. As early as 1905 I read a paper entitled "The Malocclusion of the Deciduous Teeth." In that paper I said: "I have found the most prominent cause of malocclusion is the imperfect development of the arches, and I call your attention to the development of the premaxillary portion of the maxilla."

Answering Dr. Cryer, with reference to the canine tooth being called the "keystone." No architect would call attention to a keystone so situated, because the keystone is always situated in the median line of two lateral halves of the arch. You will see that the premaxillary bones act as a perfect keystone, from an architectural, as well as an anatomical, standpoint. The failure of this premaxillary portion to expand is responsible for the narrow arch, irregularities, and by reason of non-development teeth are forced either inside or outside the proper dental arch. The essayist has called particular attention to the distal surface of the lateral incisor tooth. The nares, in deficiently developed cases, compares almost identically with the distal surface of the lateral incisor tooth, and on the development of the premaxillary portion depends the size of the nares. When you have a deflection it is on the opposite side from where the development has taken place.

Dr. Bogue. I wish to confine myself to asking one or two questions. I shall be glad to know from Dr. Mosher whether he has, at any time, investigated the question of the enlargement of the arch of the deciduous teeth with a view to securing an aid in the development of the intermaxillary bones?

Dr. Mosher. I have not, I am sorry to say.

Dr. Bogue. I was hoping the doctor had instituted some experiments of this kind that might be brought before us here, as it seems an exceedingly important part of the question. The next question is, whether he thinks the separation of the superior arch, after it shall have been partly formed, would aid in straightening the nasal septum, either the cartilaginous or the osseous portion? The septum having slipped from its proper bed and become curved, would the separation of the two sides of the maxilla result in that septum resuming its proper form?

Dr. Mosher. Mr. President and Members of the Society: You have been kind to give me so much time. Dr. Faught was generous to discuss my paper at such length, and I have little to add. Dr. Faught asked if rickets could enlarge the premaxillary wing. I do not see why not. In reply to Dr. Bogue's last question, I do not see how the separation of the maxillæ, or any such enlargement after the deviation of the septum has taken place, will do anything except keep the deviation where it is.

Dr. Bogue. Vomer spurs are formed, as Dr. Mosher has shown us. There are differences of opinion as to what takes place a little later. Dr. Brown, of Milwaukee, believes the separation of the superior maxillæ will result in a descent of the septum later on, and Dr. Quimby, of New York, has held the same view, because both of them have had cases in which they thought it occurred. Dr. Quimby's case is his own daughter. He stated to me that he himself had applied orthodontic force—namely the screw, to spread his daughter's teeth. The girl was then about fifteen years of age. She came to him on one occasion and said, "Papa, what has happened to me? It seems to me my nose feels queer, and more air is passing than before." He found her central incisors about an eighth of an inch apart. and the nasal septum distinctly straightened. He was startled, and thought he had done something very bad. The clearer air passage has remained and the space closed up. He believes the same thing might have occurred in other cases.

Evidence and Significance of Tooth Eruption.

By Varney E. Barnes, D.D.S., Cleveland.

Associated with orthodontic procedure tooth eruption has a significance in that it antedates occlusion, and thereby allows of earlier diagnosis and preventive treatment.

The eruptive tables are well known and indicate when teeth may be expected *under all conditions*, for they allow great latitude. After close observations extending over a period of ten years, I am certain that these charted eruptive periods are far from correct as regards the normal. I find that, usually, the earlier teeth erupt the better are the developmental conditions in the bone structures of the mouth. This would indicate that the earlier eruptive periods are more nearly correct. Evidence to support this lies in the fact that irregularities present generally in crowded conditions, which mean retarded eruptions. The tables have been based upon a number of *cases presumed to be, but which were not normal.* To-day irregularities are conceded to be the rule for the permanent teeth, and I believe the rule applies to the temporary teeth also, the deciduous irregularity preceding the permanent irregularity in a characteristic form (Figs. 1, 2, 3, 4, 5, 6, 7 and 8). General acknowledgment must soon come of the fact that deciduous denture deformities are as prevalent as those of the permanent denture. The best expression of this was that of Dr. Wilbur M. Dailey, who, on April 18, 1905, said:

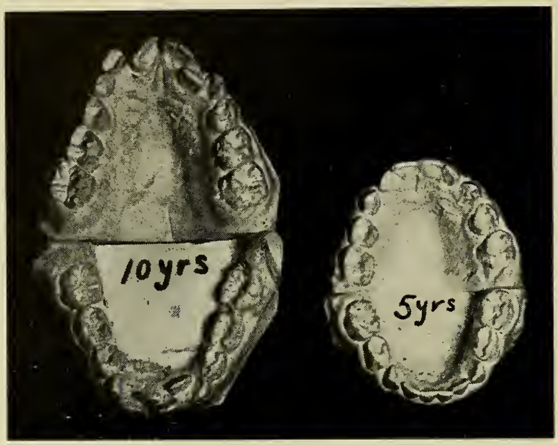

FIG. 1.

Fig. 1.—General maxillary and mandibular deficiency in cases of sisters five and ten years old.

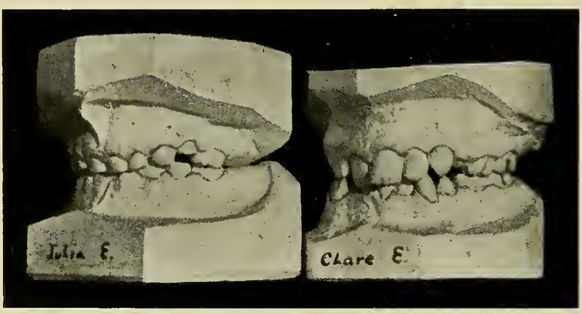

FIG. 2.

Fig. 2.—Characteristic crowding, close bite and inverted compensating curves in cases of sisters.

"Malocclusion of the deciduous teeth exists in the same proportion as it does in the permanent teeth" (*Dental Cosmos,* December, 1905). Prior to that the writer said: "The most serious cases of malocclusion are clearly indicated in the temporary teeth, may be diagnosed as early as three years, and are far more frequent than the dental profession supposes" (Northern Ohio Dental Association, June, 1904; *Dental Summary,* May, 1905).

Teeth which erupt under crowded conditions wedge into rotated and inclined positions and show the almost constant recurrence of one con-

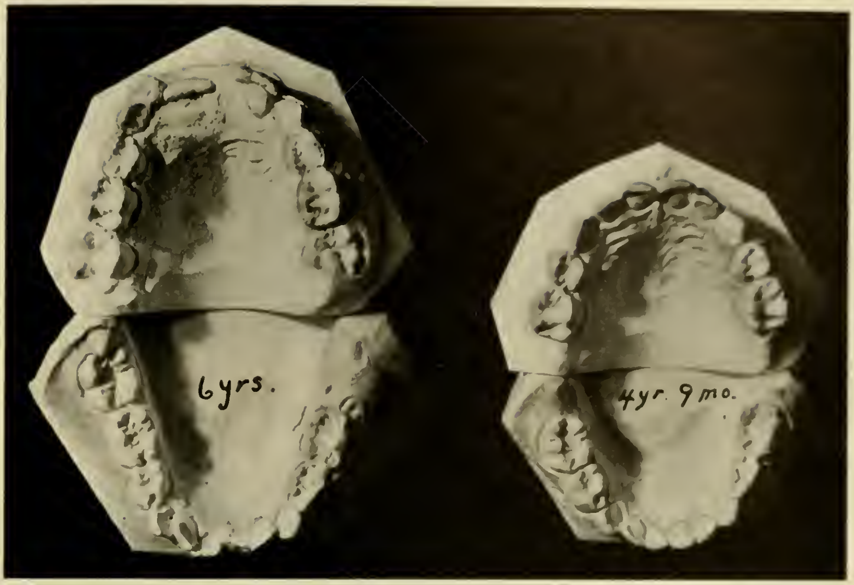

FIG. 3.

Fig. 3.—Characteristic temporary arches—brother and sister, six and four years nine months. Six-year cast showing incisors and first molars erupting into small arches.

dition—smallness of the apical arch in maxilla, mandible or both (Figs. 9 and 10). This would indicate that malocclusions are results of faulty root locations upon malformed bone.

There is a theory that teeth erupt close together, wedging and stimulating the bone to develop in the region of each tooth so as to permit it to assume a correct position in the arch. This theory of so-called sectional development assumes that the space necessary on account of the greater width of permanent incisors and cuspids over temporary incisors and cuspids appears, or increases greatly, just prior to the eruption of the permanent tooth; the whole width development increasing in periods up to the twelfth or thirteenth year, when the cuspids are erupted. This is the theory that led to that old evil advice, "Wait until the child has all the permanent teeth anterior to the first molars before beginning regulation." It has no real evidence to support it.

There is also the theory of early growth or developmental spaces between the temporary teeth. Talbot says: "The mouth of a child at the fourth or fifth year normally presents a well-developed jaw. The curves

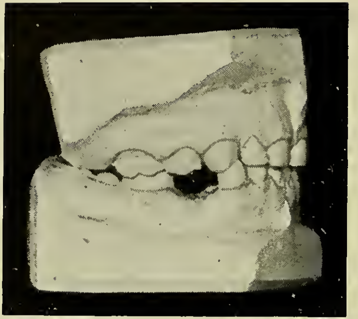

FIG. 4.

Fig. 4.—Cast of five-year-old patient—deficient spaces, overbite of upper and close bite.

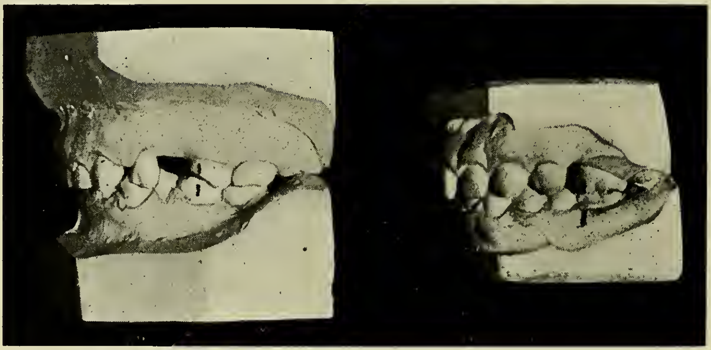

FIG. 5.

Fig. 5.—Casts of brother fourteen years and mother of patient of Fig. 4 in which the characteristic deformity is clearly shown.

are all graceful in outline, and the contour of the dental arch is well formed. This could hardly be otherwise, for the reason that the jaw is growing rapidly for the purpose of accommodating the permanent teeth, and the circle of the alveolar process is larger than that of the teeth. Spaces exist between the temporary teeth and, therefore, crowding can not take place."

The necessity for spaces has been written of and known for a long time. Previous to December, 1906, however, no one seems to have definitely located those spaces or indicated in any manner how large they should be. At the time mentioned the writer published in the *Dentist's Magazine* an article in which attention was called to some observations: First, to the prevalence of irregularities; second, to the three develop-

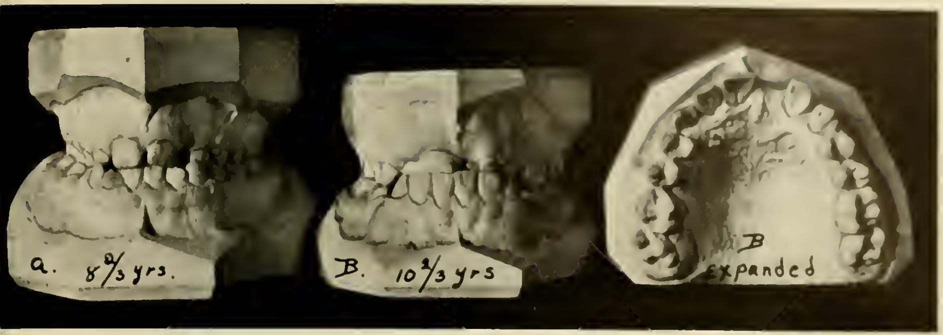

FIG. 6.

Fig. 6.—Casts showing deficient development of maxilla—brothers—transition of deformity from temporary to permanent teeth; eight years eight months and ten years eight months; and cast of maxilla of older boy showing progress and root expansion .

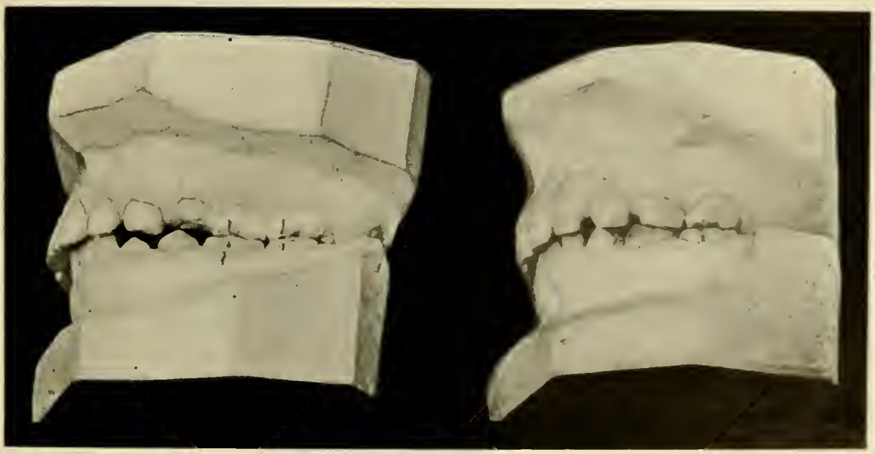

FIG. 7.

Fig. 7.—Casts of case at five years and nine years, showing characteristic deficiency of lower arches in both temporary and permanent teeth. Upper arches normal. Lower arches short and narrow.

mental directions, antero-posterior, vertical and buccal; third, to the seeming law of growth spaces, "the temporary central, lateral and cuspid plus their distal growth space equals or exceeds the width of the succeeding permanent teeth, in the normal child of four to five years of age."

Theories of Eruption and Development.

Continued observations of eruptions and development have indicated error in the former theories which are now modified and presented as follows:

1. Theory of width development. The width developments of maxilla and mandible are complete as far distal as the first permanent molars at from seven to eight years in the normal child.

2. Theory of developmental or growth spaces.

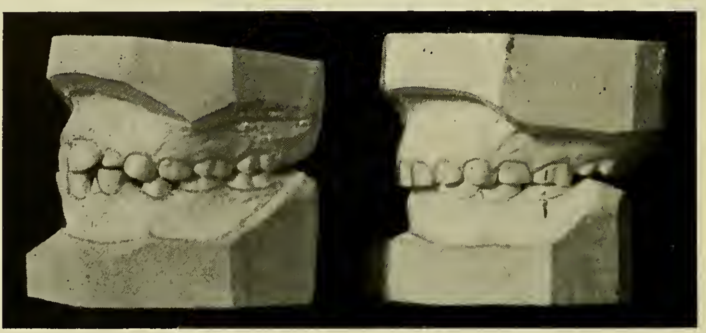

Fig. 8.

Fig. 8.—Characteristic open and close bites shown in temporary teeth and in permanent teeth erupting.

(a) The temporary laterals and cuspids plus their distal growth spaces exceed in width the succeeding permanent laterals and cuspids in the normal child of from four to five years of age.

(b) The temporary centrals plus their growth spaces exceed the width of the permanent centrals in the normal child of seven to eight years.

3. Theory of anterior-posterior development.

That portion of the anterior-posterior development of the jaws between the region of the lateral and the distal surface of the second temporary molar is complete in the normal child of four to five years of age.

4. Theory of eruption without lateral contact.

Temporary and permanent teeth normally erupt without lateral or any contact with other teeth until in occlusion.

In the study of the best obtainable dentitions (Figs. 11 and 12) we find the teeth touching only at the contact points, the roots well separated and broad V-shaped interproximal spaces filled with gum and bone tissue.

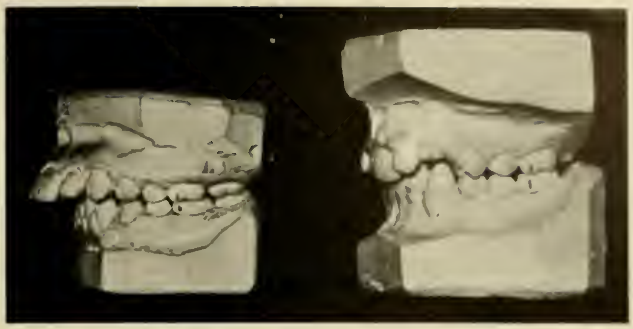

FIG. 9.

Fig. 9.—Two cases of small apical arches of most decided character.

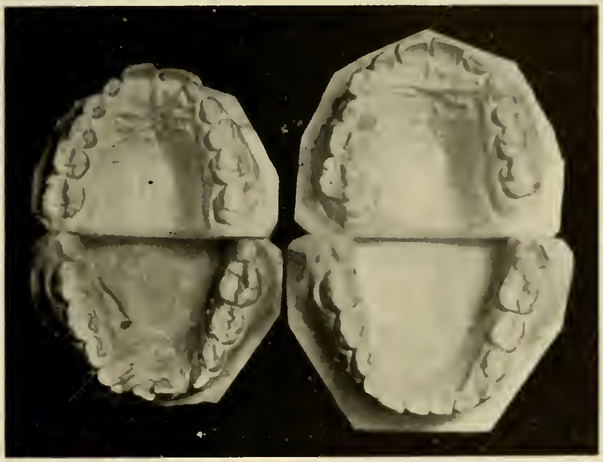

FIG. 10.

Fig. 10.—Small apical arches. Cast of patient nine years three months, and partial correction in contrast.

These conditions are found at about the age of twelve. Previous to that age the teeth are not in contact, excepting possibly the incisors. To produce these conditions only one hypothesis seems plausible, and that is, the width development of maxilla and mandible is complete as far posterior as a point distal of the second temporary molars, at from seven to eight years of age, in order that the permanent and temporary teeth may *pierce* the gums and the permanent teeth be *without contact with one another until after they reach a vertical development equal to that of the next tooth in occlusion.*

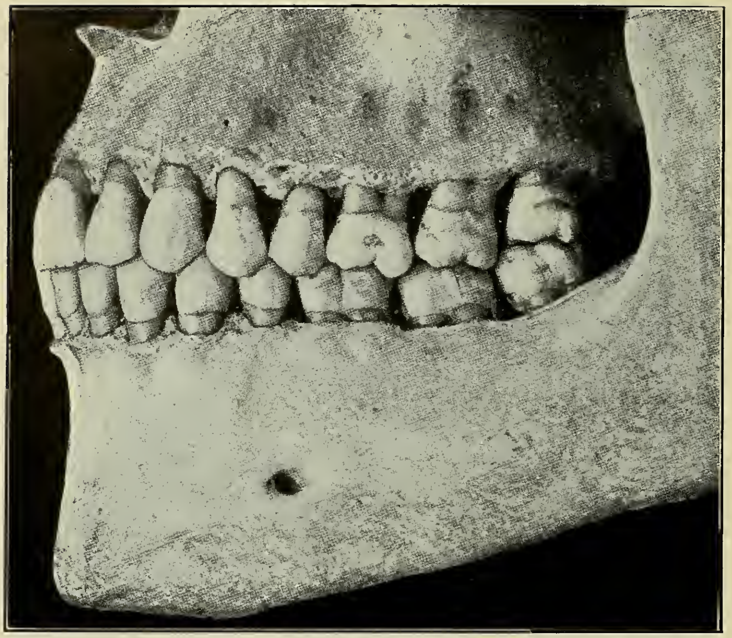

FIG. 11.

Fig. 11.—Normal occlusion (Turner).

Comparison of Temporary with Permanent Teeth.

The first evidence to support this hypothesis exists in the tooth forms (Figs. 12 and 13). The temporary teeth differ radically in form from the permanent set. Their crowns are short. The incisors, cuspids and the mesial surface of the first molar have no contact. The distal surface of the first molar and the mesial and distal of the second molar have small contact very close to the occlusal margins. The enamel on the buccal and labial surfaces presents a great slope and abruptly terminates in a ridge just before merging into the cementum. The necks are well constructed, the mesial and distal portions of the crowns have marked concavities extending well up to the occlusal margins, permitting teeth and gum to merge into a continuous contour. The incisors and cuspids are proportionately very broad at the incisive margin and abruptly slope to the cervix on the mesial and distal sides. The labio-lingual aspect of the incisors and cuspids is that of a wedge with the greater incline lingually, which would tend to erupt the tooth outward. The absence of any wedge shape, mesio-distally and pointing away from the cervix, should indicate that the tooth was made to *pierce* the gums, instead of slitting them while crowding other teeth. The wedge and concavity toward the cervix mesio-distally would seem to indicate that crowding in eruption would tend to lock or rotate the teeth.

The permanent teeth have small mesial and distal contact surfaces (except the distal surface of the third molar), which rapidly slope away in convexity in all directions, then, on mesial and distal surfaces, gradually turn to concavity. This mesial and distal convexity clearly indicates that the teeth were never designed to be, or to erupt, in contact until after the teeth had erupted to an equality in vertical height. The teeth do not erupt all together and the surfaces, almost points of contact, present too fine an approximation for any reasonable expectations of teeth erupting with mesial or distal convex surfaces balanced, sliding along first a concavity and then a convexity to contact. The wedging into position is thus absurd, especially as the wedge shape of the incisors and cuspids is labio-lingually with the greater incline lingually and, therefore, tending to erupt those teeth labially.

The cuspids have inclines mesially and distally (Fig. 11) with the greater on the distal side tending to force the tooth to the mesial in eruption. The first upper bicuspids have inclines on the buccal cusps with the greater on the mesial tending toward a distal position, but possibly counteracted by the mesial inclination of the lingual cusp. The second upper bicuspids have the greater incline on the distal side of the buccal cusp augmented by the mesial inclination of the lingual cusp and showing a mesial tendency in eruption. This brings us to the consideration of a second evidence.

The temporary molars exceed the succeeding bicuspids in mesio-distal diameter. This excess in width has been erroneously said to be for the relief of any crowding anterior to the first permanent molars. X-rays show the second bicuspids between the roots of the second temporary molar, and where there is even an approximately good arrangement of the anterior teeth the second bicuspid erupts to the mesial, leaving *a considerable space mesial to the first permanent molar.* At the time of the eruption of this second bicuspid (about ten to eleven years) there is a considerable growth taking place posterior to the first molar. This is preparatory to the eruption of the second molar, and it brings a mesial pressure which forces the first molar forward (Fig. 14). Were it not for that extra mesial space the bicuspids would not have time for full vertical eruption and would be most liable to be caught and locked in or rotated (witness that very common condition in the crowding of irregularities). Nature has thus wisely endeavored to prevent stress in bicuspid

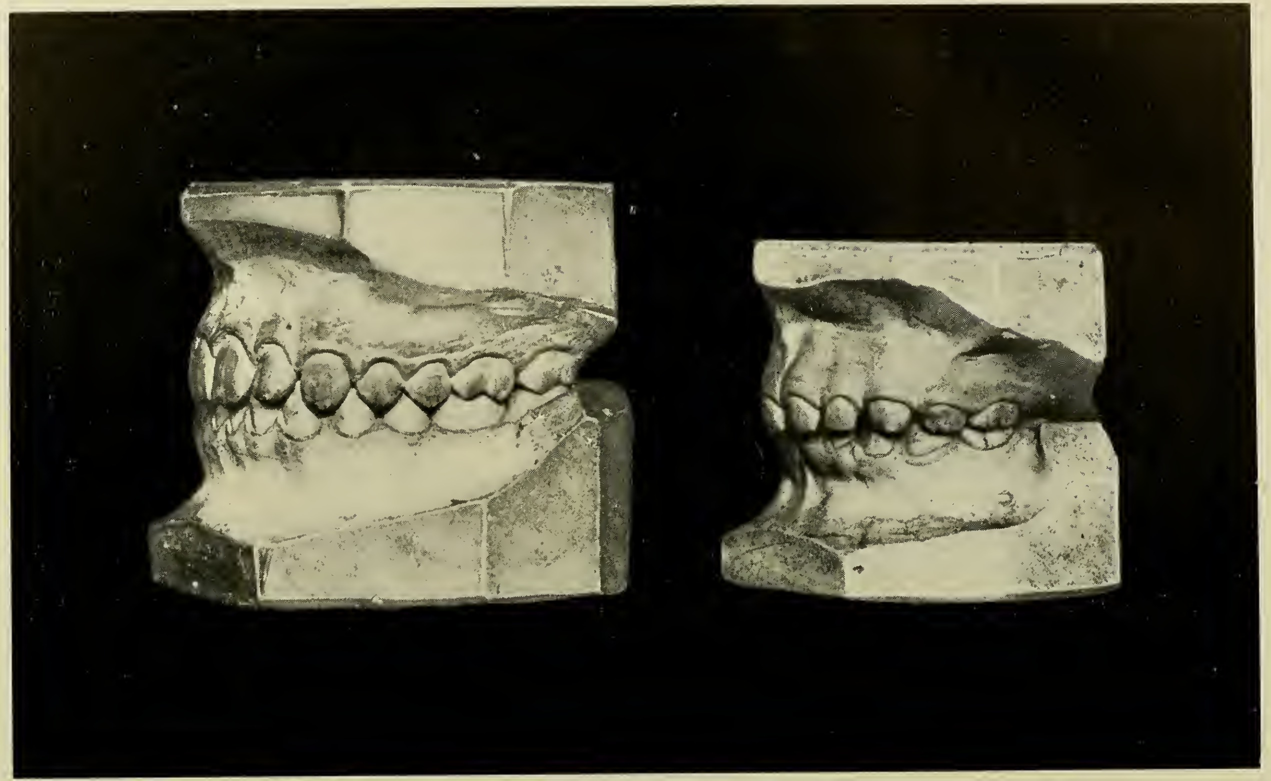

FIG. 12.

Fig. 12.—Normal dentitions (lower of temporary deficient).

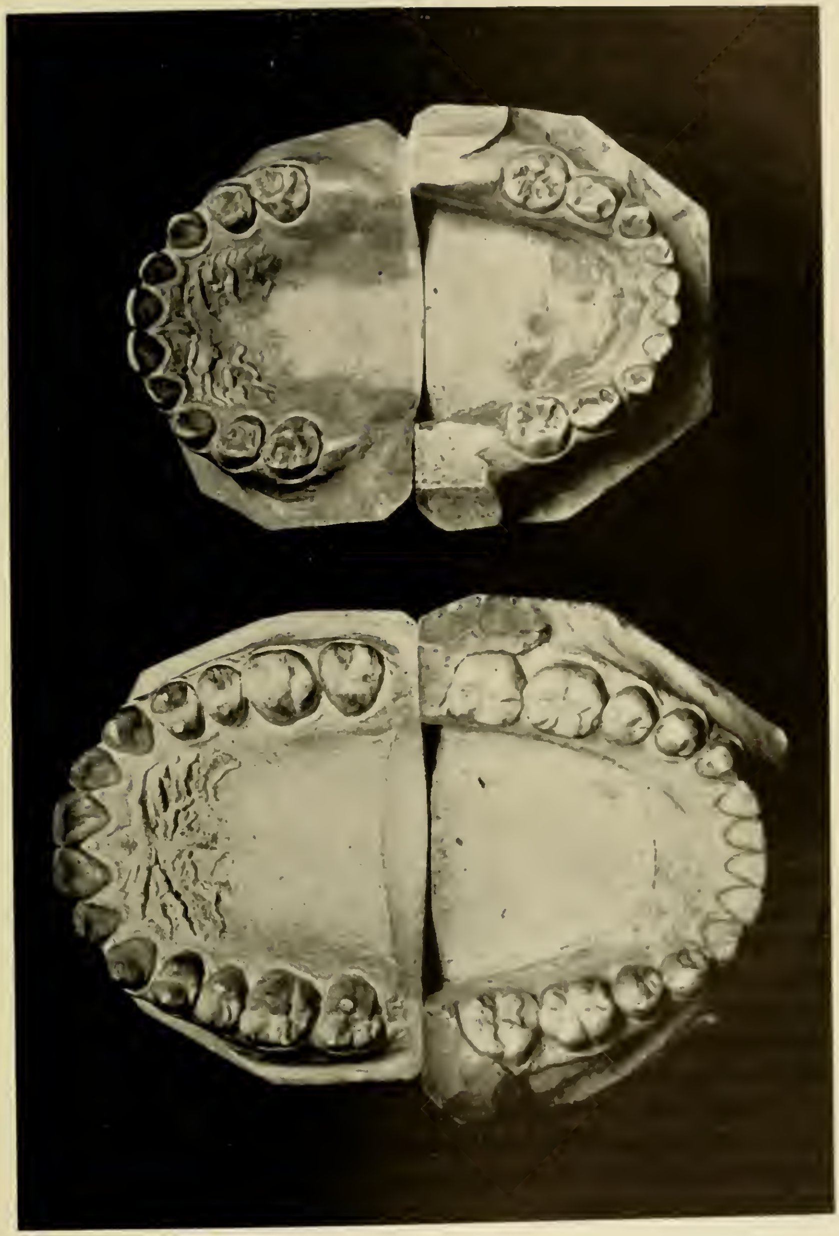

FIG. 13.

Fig. 13.—Contrast in forms of temporary and permanent teeth.

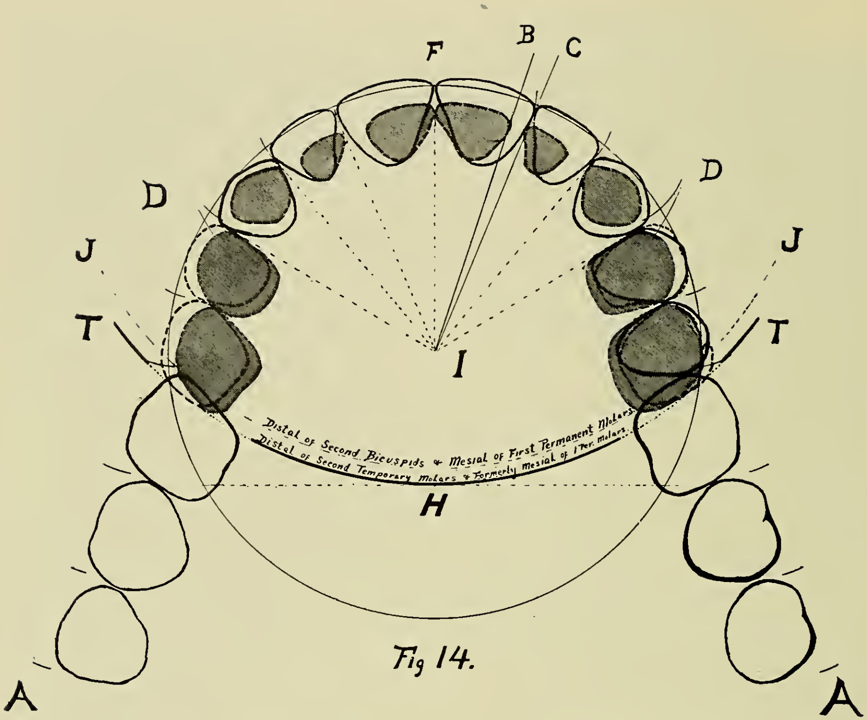
F
B
C
D
D
J
J
T
T
I
Distal of Second Bicuspids & Mesial of First Permanent Molars.
Distal of Second Temporary Molars & Formerly Mesial of 1 Per. Molars.
H
A
A
Fig 14.

Fig. 14.—Illustrating the position of second temporary molars and first permanent molars and the shifting forward of the first permanent molars while bicuspids are erupting.

eruption. Why not also for the incisors and cuspids? The very forms of all the teeth are such as to make rotations extremely liable under stress eruptions, and the very prevalence of rotation of all teeth, incisors to molars, is evidence that wedging in any form is not normal.

The point raised in regard to the *piercing* of the gums, instead of *slitting*, necessarily a result of wedging eruption, applies even more forcibly to the permanent teeth. It is an acknowledged fact that pyorrheal conditions are associated with irregularities in tooth positions. It is also acknowledged that these malpositions are generally associated with crowding in eruption. Crowding in eruption means that the gums are *slit*, that the labial and lingual sections are separated and that flaps form, preventing proper cervix constriction, and thereby predisposing to irritation, then inflammation and pyorrhea if not really being a chief factor. The *piercing* of the gums by teeth erupting without lateral contact would

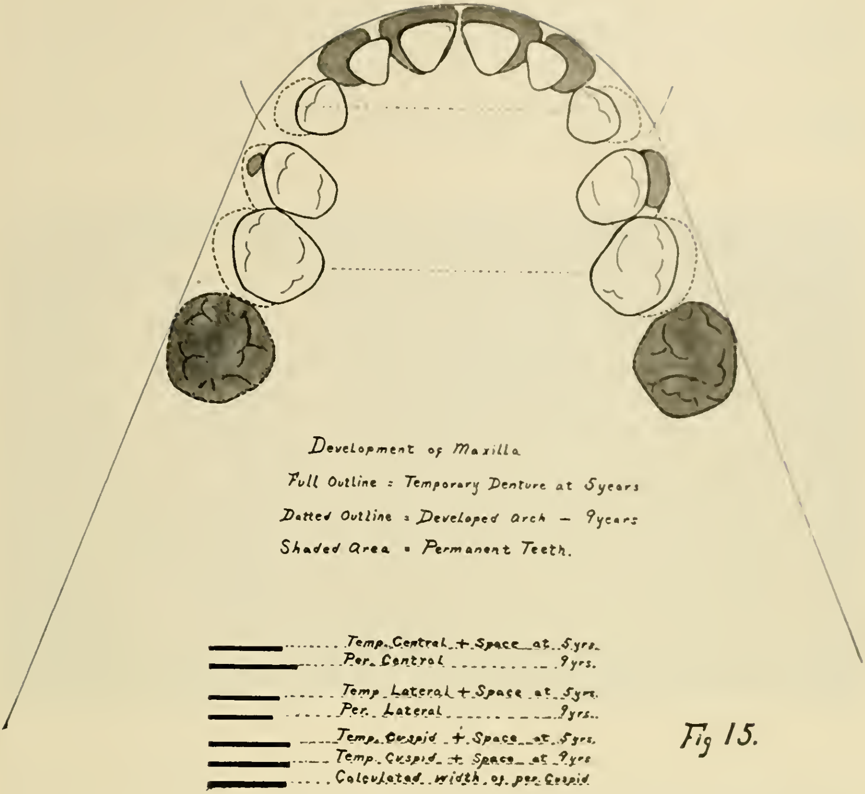
Development of Maxilla
Full Outline = Temporary Denture at 5years
Dotted Outline = Developed arch – 9years
Shaded Area = Permanent Teeth.
Temp. Central + Space at 5yrs.
Per. Central 9yrs.
Temp. Lateral + Space at 5yrs.
Per. Lateral 9yrs.
Temp. Cuspid + Space at 5yrs.
Temp. Cuspid + Space at 9yrs
Calculated width of per. Cuspid

Fig 15.

Fig. 15.—Chart from casts shown in Fig. 7, showing development in four years in normal upper arch.

leave a *ring of gum tissue* designed and prepared to contract about the cervix however constructed it might be.

Importance of Developmental Spacing.

An evidence of the necessity of the early complete formation of the developmental space distal to the upper cuspid exists in the fact that the lower cuspid erupts normally at about nine years to a position mesial to upper cuspid. To do so it must have its distal space early to prevent encroachment upon the area of the first temporary molar, which is not due to be lost until after the cuspid erupts (nine to ten).

Evidence of necessity for early developmental space distal to lower cuspid is found in the fact that *well-developed temporary arches contain* *that space at from four to six years* (Fig. 13). A further evidence of the early width development, and of the size and time for growth spaces is in two sets of casts which I have been fortunate enough to obtain and study (Fig. 7). They are from the mouth of a well-developed child, and were taken at the ages of five and nine years. The five-year cast shows a full arch, singularly well contoured with large developmental spaces distal to temporary laterals and cuspids, and smaller spaces distal to the temporary centrals. (The development in the mandible seems not quite so good as in the maxilla and is not presented as normal.)

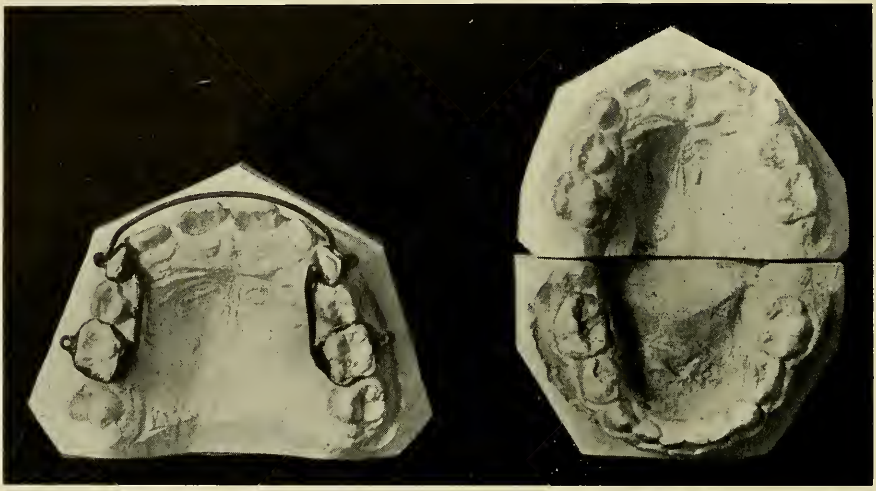

FIG. 16.

Fig. 16.—Casts (before and after treatment) from actual case, showing vertical hinge appliance used and space for normal eruptions. (Modification of Dr. Ainsworth's appliance.) (Root expansion.)

The nine-year cast (Fig. 15) (maxillary calculated to be normal) shows the growth space distal to the cuspid remaining constant during four years and *exceeding the calculated width of the cuspid.* The permanent laterals are in position and occupy *less* space than the *temporary laterals* and their distal spaces. The permanent centrals are in position and occupy a *greater space* than the *temporary centrals and their distal spaces* occupied. There is also a widening of the arch to an extent which has a significance, in that the *excess in width of the permanent centrals over the temporary centrals and their distal spaces equals the excess in width* of the nine-year cast over the four-year cast, *measured across the cuspids and second molars.*

This would seem to indicate that the *development was not sectional*, but *along the median suture* and *marked the completion of the width development.*

The lateral and cuspid spaces remaining constant indicates that the width development is complete at or before the time of eruption of the permanent central incisors.

In opposition to the theory of sufficient growth spaces to permit of tooth eruption without contact, is the fact that some apparently very good occlusions follow crowded eruptions. A careful study of these occlusions will reveal the fact that they are all too narrow to be ideal, their interproximal spaces are deficient, the teeth are forced tightly together, and in nearly every instance the third molars are not in a corresponding good relation with the remainder of the denture. What probably occurs in these cases is that, each tooth as it crowds into the arch does so *at the expense of part of the space of the next tooth distal to it.* This condition is reflected backward and finally culminates in the more marked displacement of the third molars. The evidence that seems to support this is found in the fact that *whenever teeth occupy distal positions they are almost always rotated,* and that there is universal malpositions of third molars, particularly noticeable in lower arches. Another objection to this theory is that we have some cases which are seemingly regular at twelve to sixteen years, and then suddenly distort from pressure associated with eruption of posterior teeth.

The significance of the theories advanced is, that we recognize the importance of beginning our corrective treatment of malformations at as early an age as the little patients can be handled intelligently (four to six years). It means that we should not expect any measurable amount of growth to occur through pressure *stimulation* in developmental directions which are long past their natural period of growth. It means that whenever we diagnose *root inclinations or small apical arches* (deficient growth spaces) we shall apply corrective treatment in a direct force to those roots in order to carry the temporary and permanent teeth at once to their true positions (Figs. 16 and 17 B, vertical hinge appliance principle). It means that generally no distal movements of teeth, whether intentional or not, are normal and that such movements must be recognized as compromises, for they encroach on the area of distal teeth yet to come. A further significance is that the classification of dental deformities according to the mesio-distal relations is too narrow and misleading, for that classification does not cover the temporary denture deformities (Fig. 7); at least it can not be definitely applied.

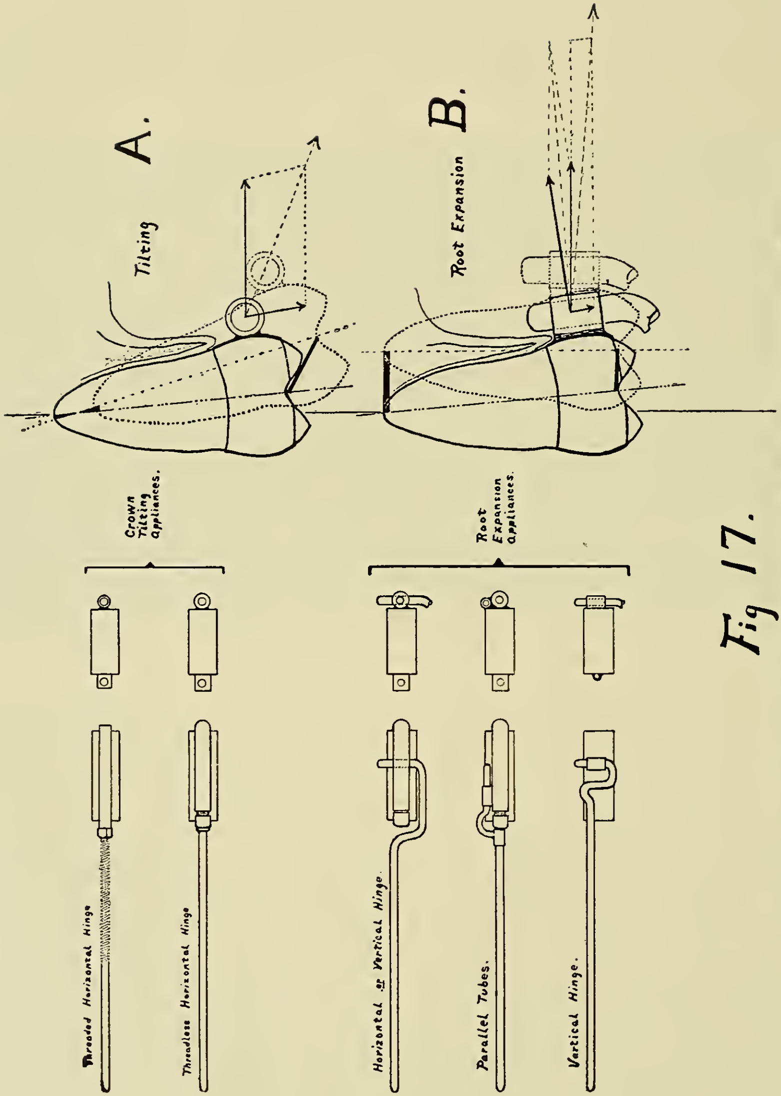
A.
Tilting
B.
Root Expansion
Crown Tilting appliances.
Root Expansion appliances.
Threaded Horizontal Hinge
Threadless Horizontal Hinge
Horizontal or Vertical Hinge.
Parallel Tubes.
Vertical Hinge.

Fig 17.

Fig. 17.—Comparison of vertical and horizontal hinge appliances

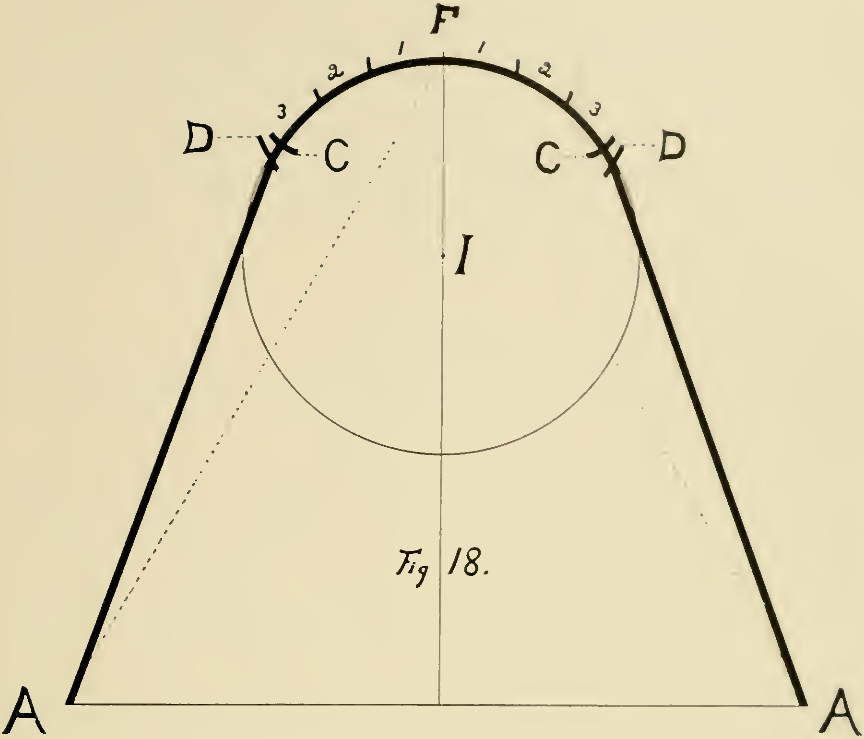

Fig. 18.—Illustrating the error in Bonwill's calculation and the possibility of an ideal arch for eruption.

Treatment and Retention.

In our corrective treatment of malposed teeth and malformed bone (using the horizontal hinge appliance, Fig. 17 A) we may secure, seemingly a very good occlusion and yet have faulty root and apex position. This occlusion may be retained for years, or, in some instances, permanently, but will usually fail soon after the removal of artificial retention devices, or upon the growth and pressure associated with the development and eruption of posterior teeth, or after separation for operative procedure. This failure in retention is due not primarily to failure of surrounding alveolar bone to hold the teeth in their new positions, but *failure to secure normal root positions.* In other words, *failure in retention is a result of incomplete or incorrect regulation.*

The problem to-day in orthodontia is *not retention*, but still *how* best *to treat* so as *to obtain approximately normal results*, or *how* or *when to compromise* after an intelligent effort to obtain that normal.

It has been claimed that roots will straighten up and the apical arch expand after the crowns are moved into relatively normal mesio-distal relations and retained. The idea of this entire claim is that the jaws may and do, develop in breadth at an age later than seven or eight years. It is dependent upon the crowded eruption theory. This expansion may possibly happen to a very limited degree through the *stimulation* of that portion of the vertical bone *development still incomplete,* but it is more improbable than possible that the width deevlopment is so stimulated, and it must not be depended upon to occur in too many cases now under indefinite retention.

What probably does happen in these conditions is that nature fills in new bone over the roots in their new positions after the teeth (chiefly the crowns) are tilted buccally, and there is a seeming expansion which is later seemingly improved after the removal of retainers with the consequent lingual tilting of the teeth to a contact.

Teeth have an eruptive force which raises them from their crypts and places them in occlusion. Under the wedging theory of eruption that force has been credited with aiding in jaw development. Under the early developmental space theory that force I credit with only vertical action upon the erupting tooth, it may exert a circumferential pressure on acount of resistance met, but the primary action is vertical. When this is realized and associated with the fact of almost universal small apical arches the premature loss of deciduous teeth will not be credited with being so great a factor in the causation of malocclusions as it now is. I do not mean to minimize it as a factor, but would take from it the credit due to deficient bone development.

The correctness of the theory of sufficient growth at seven to eight years to permit permanent incisors and cuspids to erupt without contact seems to be corroborated by clinical experience. The features of children who have deficient or no growth spaces are prematurely aged. The artificial opening of those spaces between the temporary teeth, through the bodily lateral movement of temporary teeth and permanent teeth beneath them, brings a far more youthful expression to those same features. This treatment often *opens the medium suture* and thereby *increases the area of the nasal passages, providing better oxygenation,* and thus *aiding a better development* of the entire system.

There is possibly no ideal arch, but if there is, that of Bonwill based upon the equilateral four-inch triangle seems to offer the best guide as to what to expect. In his calculation of the circle there is an error in laying off the radius and then laying off the individual teeth, making arcs and resulting in the distal position of the cuspid not coinciding with the theoretical position claimed. Associating this apparent error with the theory of sufficient growth spaces there has arisen the thought that possibly the one might be the explanation of the other; the theoretical arc (F-D) being greater than the sum of the applied arcs (F-C), and the growth spaces greater than the width of the teeth erupting (Fig. 18).

A final evidence of early dental deformity is in the difficult teething of infants. This difficult teething may be taken as one of the first diagnostic signs of dental malpositions of both permanent and temporary teeth.

Discussion of Paper by Dr. Varney Barnes

Dr. Wilber M. Dailey, Dr. Barnes has given us a paper that will be food for thought for years to come. It has required the observation of years, on the part of Dr. Barnes, to arrive at these deductions, and it will take considerable time on the part of the dental practitioners to prove and make these statements facts.

The simplest process at times is the most difficult to explain in a manner to be thoroughly understood by your audience; but Dr. Barnes has excellently portrayed, in few words, the jaw development; the position and manner in which the tooth erupts.

Dr. Barnes, in speaking of eruption, states that by knowing the ideal you will know how to assist the development of the bone at the age which Nature intended the development, and advises us not to wait until the normal developmental period has passed, and then expect normal development in the cancellous bone.

I have had failures in orthodontia, but have recognized the deficiency and the short-comings and have tried to ascertain the cause; and I agree with the essayist that the only correct manner to treat these cases is from the standpoint of etiology of early development. By turning to the normal, therefore, you are able, by means of an artificial stimulus, to develop, as nearly as possible, the ideal.

Dr. Barnes has spoken of eruption tables, and I would like to suggest here that the members of this society tabulate the eruption of the deciduous and permanent teeth, and if the men of other societies would cooperate in this, we would then have sufficient data to arrive at the average time of exfoliation of deciduous teeth and eruption of permanent teeth, instead of using those tables which have been handed down for fifty or a hundred years. And, further, if we would preserve the deciduous teeth as they are removed, and take the measurements of them, and also of their successors, the permanent teeth, then the accumulated data would give us charts or tables of scientific value.

The statements in Dr. Mosher's paper regarding the lateral development of the premaxillary bones are borne out clearly by the cases at five and nine years, shown by Dr. Barnes. The lateral development can be definitely appreciated.

The developmental process is not well understood, and it would be of great advantage if we would submit models of arches that are developing normally; such a collection would give us sufficient data to arrive at the scientific prognosis in cases of non-development.

The statement that Dr. Barnes attributed to me (that malocclusion of the deciduous teeth exists in the same proportion as the permanent teeth) is not to be understood as meaning the relative positions of the teeth only, but that the lack of development in the deciduous arch is a malocclusion in the sense that the spacing so necessary between the teeth to insure sufficient room for the permanent teeth is absent.

The process of development is apt to confuse one, for between the ages of five and six years the distance or development between the premaxillary bones and the sixth-year molar seems to have been retarded, but about the ninth year develops very rapidly.

I understand that the apical arch which Dr. Barnes mentioned means an imaginary line around the apices of the teeth, expressing the proper normal bone development at that point.

In the Items of Interest for September and October Dr. J. Bethune Stein presented a paper calling attention to bone structures, in which he does not mention "alveolar process" at all. It is all *bone* of the mandible and maxilla. He says he has never found, in his research work, a line of demarcation between alevolar process and true bone; that it is all one.

Dr. E. A. Bogue. Dr. Barnes is correct about the deficiency in the periods of eruption as published, because they are incorrect.

Dr. Barnes showed a model of a three-year-old patient, and stated, as I understood him, that between the taking of that model and the present time there had been no lateral development. That is a point of importance. I think he is correct, and I could duplicate such models as that, because wherever we find irregularities of the upper teeth I think we usually find the tongue has failed to do its lateral work. He showed us the spaces adjoining the temporary teeth which he believes to be indications of the positions of the permanent ones underneath. He spoke of them as deformities, although I hardly think he meant them as deformities, but rather as indications of conditions that were leading to deformity. He also said the wedging process is absurd, for the greater incline is lingually, and, therefore, the teeth tend to erupt labially. There is an exception to that: Dr. Barnes took it into account. The upper permanent incisors may tend to erupt labially, but they are restricted by the circle of the temporary roots, behind which they lie, and if those temporary roots do not get out of the way they will deflect the permanent teeth lingually as they erupt.

He speaks of the lateral development of the jaw being complete at four or five years of age. That is an important point for all of us to bear in mind, because the teaching of his paper is that if we find at four or five years of age the development of the temporary teeth is not such as to show us the spaces and the conditions that attend a perfect eruption of the permanent teeth, we should at once begin to enlarge the temporary arches.

The explanation with reference to the temporary arches is a matter of interest, if the permanent teeth are to come through correctly. Dr. Barnes made a little error. I know he did not mean to, in speaking of the "Ainsworth arch" as being designed to bear on the incisor teeth above. Dr. Ainsworth says his arch *may* be used for that purpose, but that is not its primary use.

Dr. Barnes Was that not his first design when he brought it out?

Dr. Bogue. I think it was a feature which he discovered after he first used it. I can not answer exactly.

Another thing which Dr. Barnes implies is that irregular arches of teeth do not enlarge laterally without extraneous help: neither the temporary nor the permanent. He speaks of the "eruptive forces." I have not heard, in this paper, that eruptive force pointed out. I think it has been more accurately studied by Dr. Wright, of Boston, than any one I know. The eruptive force is the pulsation of the heart. Dr. Barnes also says no distal movement of the teeth is normal, and that our problem is rather to guide into a proper eruption, wherein I think he is entirely right.

So far as I can see, Dr. Barnes's paper is but the beginning of investigations which may show us how we may guide the very young child so that it will not have need for orthodontic services later on, and among those influences to be used it is our province to suggest the advantages of hard foods and the use of the jaws at the earliest age, and to work along with the medical men, who generally direct the feeding of the child at the time of weaning, each helping the other to keep the child in hygienic condition.

Dr. Danforth. In relation to Dr. Barnes's theory that by enlarging the temporary arches to normal the teeth will erupt more perfectly, that accentuates Dr. Mosher's ideas; if in producing these spaces you will stimulate the eruption of the teeth and the development of the premaxillary bones, you might at the same time prevent the deflection of the nasal septum, which may be due to the lack of eruption of these teeth. These theories are of importance with relation to the proper development of the nasal septum, therefore, as well as to the normal occlusion of the teeth.

Dr. Hawley. Finally, our correction will come back, not to the treatment of deciduous teeth by appliances, but to the use of proper foods and the development of the child normally. If we could produce that result by selection of food, etc., we would accomplish something for the human race.

Dr. Danforth. If we could see the children forty generations back we will have to do as Dr. Barnes does with the proper feeding.

Dr. Pullen. I want to commend Dr. Barnes's paper. It has been no surprise to me that he, Dr. Barnes, has so completely elaborated the subject during the last three or four months, and he deserves much credit for his hard labor. The essay presents proof that the work the orthodontist is doing to-day is the artificial development of the dental, alveolar and maxillary arches, as contrasted with what has been styled "straightening crooked or irregular teeth."

Dr. Barnes. What I have presented has been the best that I could do in a new field. While all that has been brought forward may not seem plausible to you, still I ask that you begin to investigate, and then, in time, we may get at the truth. The one particular case shown may not be normal, but, in the absence of evidence to the contrary, I believe it is. Get casts a year apart, as I am doing in many cases, and I believe that in five years we shall have evidence of eruptions and development that will be indisputable. We can not obtain skulls of normal infants. I have yet to see what I consider a normal skull having a normal temporary dentition. Dr. Cryer says he has them, and although he knows more anatomy than I do, in the light of the evidence presented to-day, I doubt it.

The study of development incident to eruption of the teeth will be continued, but it is too great a field for one man. We have to face the evidence of anatomists—and their evidence is indefinite, for it is based more upon the abnormal than the normal in skull development.

I thank you for your consideration and attention, and again ask for your study of this subject.

Treatment of the Displacement of the Inferior Maxilla, Caused by the Partial Resection of the Body of the Bone.

By Dr. Jose J. Rojo, Professor of Orthodontia and of Dental Prothesis in the Mexican National Dental School, Member of the International Dental Federation, etc.

F. C., fifty-five years of age, of a healthy constitution and good antecedents, affected with osteomyelitis of the inferior maxilla in the region of the left molar, was treated surgically at the General Hospital, first by Dr. Leopoldo Castro, and then again by Dr. Regino González, the eminent surgeon.

Clinical History.

The disease of this patient began with the extraction of the second left molar, which was affected with a severe alveolar abscess; the extraction was made with an application of chlorid of ethyl. I believe I have observed auto-infection of maxillary bones in several cases following upon the application of chlorid of ethyl, and it occurs to me that owing to the intense chilling there are mechanical movements of the blood, pus, etc., of the anesthetized region, which facilitate the absorption of infecting liquids; for this reason I never apply chlorid of ethyl for the extraction of abscessed teeth, and strongly recommend that it should not be used in such cases.

The very evening of the day on which the molar was extracted the patient had fever; the fever continued the following day, and the inflammation and pains increased in a very marked degree. Two days later he entered the hospital, and an extra-buccal operation was performed upon him for the resection of a portion of the maxilla, in the region where the molar had been extracted, extending from the second bicuspid to the angle of the body of the bone. Before the incision of the first operation had completely cicatrized, and after having waited the necessary length of time, he underwent a second operation of major surgery, which was very successful, several fragments of diseased bone having been removed. Two months later, when the intra-and extra-buccal incisions were completely cicatrized, the patient was brought to me, through the kind courtesy of the eminent surgeon, Dr. González, to have his teeth examined. After an examination of his mouth, the necessary cleansing operations and preparatory treatments were effected, and it was decided to correct the malocclusion.

Fig. 1 shows the marked deformity of the antero-inferior part of the face, due to the displacement of the teeth. The mentum is twisted toward the side operated upon, the lower lip is depressed and folded, which, by the effect of contrast, make the upper teeth appear to be protruding. It should also be observed that the left cheek is very prominent owing to the relaxation of the muscular insertions, which, in a most marked degree, contributes toward the deformation of the physiognomy.

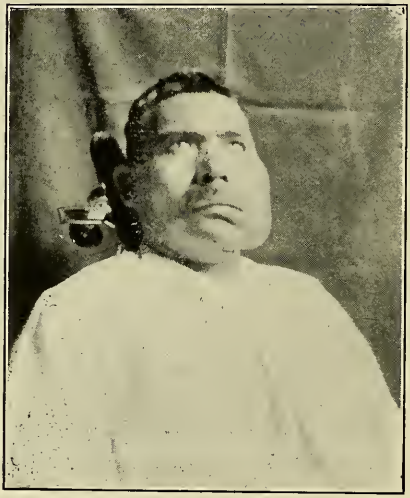

FIG. 1.

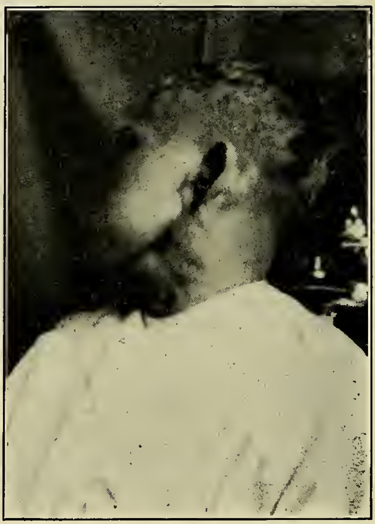

FIG. 2.

Fig. 2 shows the enormous scar which commences in the parotid region, and, following the contour of the lower border of the body of the bone, ends at the symphysis of the mentum. This incision is the principal cause of the enlargement observed in Fig. 1 on the operated side, and it has been observed in various patients that owing to the vitality of the essentially vascular tissues, these, of their own accord, contract or distend, as may be required; it has also been observed that these deformities (enlargements), of their own accord or aided by massage, reduce until they become almost imperceptible.

Fig. 3 shows the displacement of the teeth, there being a space of two centimeters between the lingual surface of the upper cuspid and the buccal surface of the corresponding lower tooth. This photograph suggests the difficulty, and perhaps the utter impossibility of proper mastication.*

It is to be feared in these cases that, owing to the abnormal state of the region, either because the dental arches are subjected to the pressure of oblique forces during mastication (that is to say, the upper teeth in a linguo-buccal direction and the lower ones in a bucco-lingual direction), or to disuse at certain points, the conditions get worse day by day, bringing on caries or displacements of the natural teeth which were saved in the surgical operation.

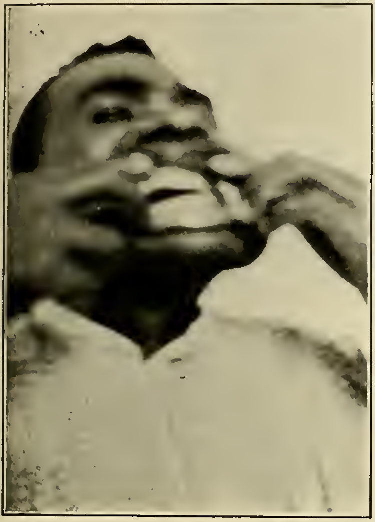

FIG. 3.

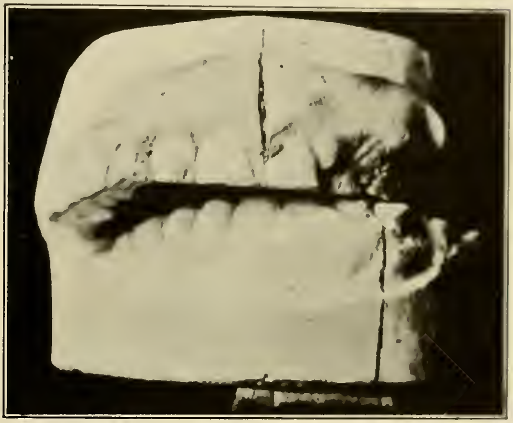

FIG. 4.

On the other hand, it might be supposed that dental prothesis could aid these patients. However, to avoid entering upon a general study of the subject, let us consider this concrete case, and we shall observe that a system of artificial teeth set in a plate would not give good results, and that a system of bridgework, besides all the trouble it would give the patient, could not be employed with success; that is to say, they could not permanently restore the masticating functions without either causing him considerable inconvenience or threatening future complications. It is also evident that the facial deformity would not be helped in the least by either of these two systems.

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* I would consider it useless or out of place to deal with physiological or psychological questions at any length in this paper, but as these two branches of science are of such great importance in these cases, I wish my readers to bear in mind how essential proper mastication is, and how important it is that a human being should not feel that he is deformed and an object of derision among his fellow-men.

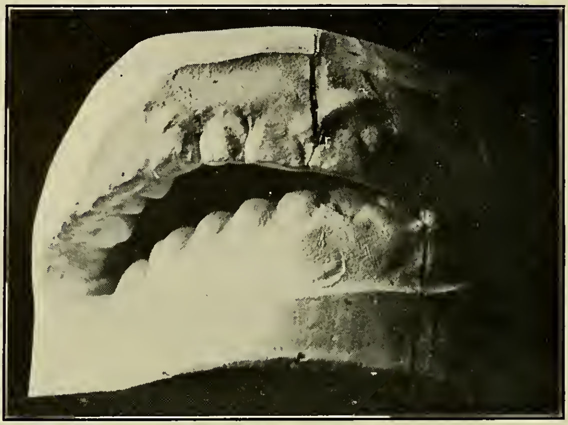

Fig. 5.

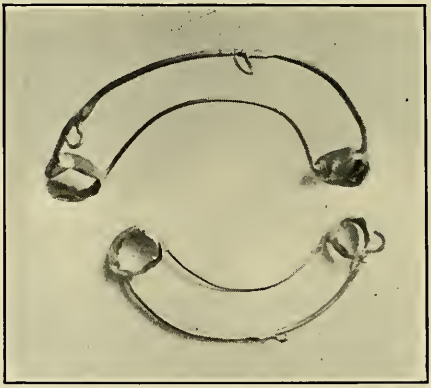

Fig. 6.

Figs. 4 and 5 are photographs taken from a plaster cast, the impression of which was taken in composition simply to study the bite. In these can be observed the deviation of the median line with considerable accuracy, being approximately two centimeters, and also the retroversion of the mandible, of about the same extent. These two irregularities render mastication impossible, give the voice a defective timbre, and disfigure the physiognomy in a marked degree.

These photographs also show how good and serviceable were the teeth which were saved, and how well they could be properly utilized.

Treatment.

Fig. 6 is a photograph of the regulating appliance, contrived after the principles of the Angle School. The metal used in its construction is German silver, its different parts being joined with silver solder (two parts of silver, one of brass). Both the upper and the lower parts each consist of two bands, adjusted upon the first bicuspids, to which are attached two 16-gauge wires (American gauge), which surround the anterior teeth, generally touching the most prominent points of the buccal and lingual surfaces. It must be remembered, in placing these, that they have two purposes: First, to equally distribute, among a greater or lesser number of teeth, the force which is necessary to reduce the displacement of the bone, taking into consideration the extent of the necessary movement, the muscular resistance and that of the ligaments, the state of the teeth, etc. It will be observed in the present case that in each of the pieces the force is distributed among eight teeth. Secondly, to secure an anchorage for the ligatures which are to effect the movement. The exterior wire arch of the upper piece is near the neck of the teeth, and it has two hooks, bent in a downward direction, their openings being on the side opposite the region operated upon; one of them is at the median line and the other is near the bicuspid. These hooks are placed on a level with the cutting-edge of the teeth to prevent the elastic ligature which they are to support from acting in such a way as to move the particular tooth with which it would come in contact if its extremity were fixed to the wire which is near the neck of the teeth. In other cases the hooks have been omitted, the wire being placed near the cutting-edge and the

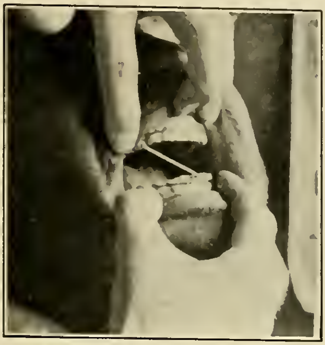

Fig. 7.

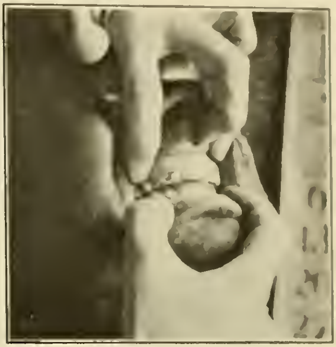

Fig. 8.

ligatures fixed directly to it without using an intervening hook. The interior or lingual wire of the upper part of the appliance may be left out, though it greatly strengthens the bands.

The buccal arch of the lower appliance is placed at a distance of one millimeter above the neck of the teeth; it is not absolutely necessary that it be closely fitted to the teeth. It has two wire hooks, opening toward the side operated upon and bent toward the cutting-edge, which support the traction ligatures. The lingual arch should touch the teeth at a proper point so as to prevent it from slipping out of place, owing to the peculiar contour of the labial surface of the teeth. The principal object of this wire is to distribute the traction force over the teeth which it touches.

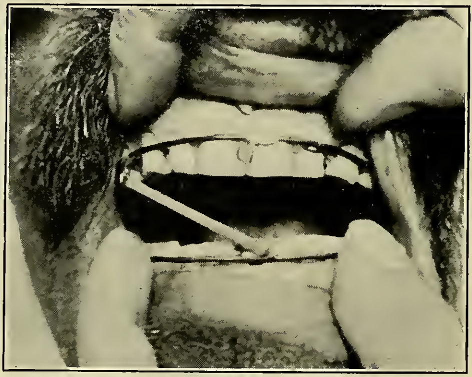

Fig. 9.

To adjust and solder these wires, as well as the hooks, it is necessary to place the bands, already soldered, in their proper positions and take an impression. When the latter and the bands have been removed from the mouth and placed in the impression, this is filled and a cast is obtained on which the wire arches can be easily adjusted and soldered by the usual methods. The hooks can be soldered after the wires and bands have been soldered and removed from the plaster cast.

In fixing these appliances in position it is good practice to make the patient wear, for the space of twelve hours, an elastic rubber wedge on the interstitial face of each molar which is to carry a band, so as to separate the teeth and facilitate the placing of the appliances.

After trying the pieces in the mouth, the molars and the bands are cleaned and dried, balls of cotton, alcohol and hot air being used for this purpose. When the parts are dry a little semi-fluid cement is mixed and applied upon the molars and within the bands, and the latter are placed in position with great care to avoid getting them out of shape.

The appliances should not be set into action until two or three hours after they have been fixed, so as to give the cement time to harden.

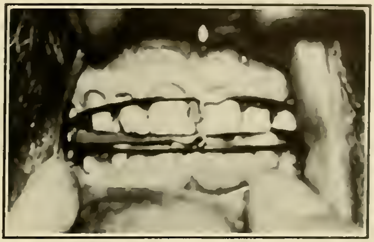

FIG. 10.

Fig. 7 shows how the appliance works, the hooks of the buccal arches being used to fix, by means of silk ligatures, a strip of elastic rubber, or a circular rubber band, the strip being preferable to the latter because its tension may be increased or reduced when found necessary.

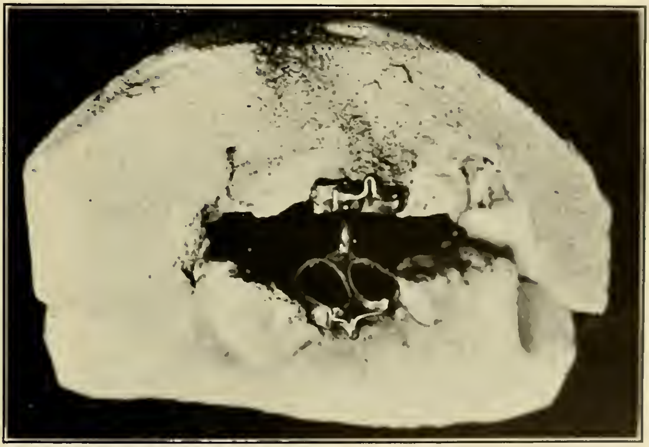

FIG. 11.

These elastic strips should be renewed every forty-eight hours, and it will be necessary, especially on the first day, to frequently examine the patient (once or twice a day).

The greatest care must be observed as regards the food allowed the patient, the mastication of solids being entirely eliminated; but it must be remembered that this diet does not last long, for in the majority of these cases the reduction of the bone is effected within a few days.

Extreme cleanliness of the mouth is also of great importance in these cases.

Fig. 8 shows the progress made a few days after the treatment was commenced.

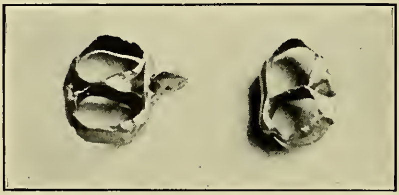

Fig. 12.

Figs. 9 and 10 show that the dental arches are in their normal relations, and that the regulating appliance has accomplished its purpose.

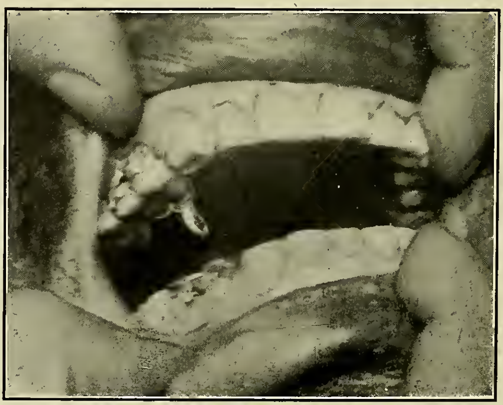

Fig. 13.

Four days after the treatment was commenced it became necessary to extract the second and third upper molars of the side operated upon, because, owing to the reduction of the maxilla, these teeth, which would perhaps never be of any use, lacerated the cicatricial tissues of the mandible.

The complete reduction took about fifteen days. Notwithstanding the fact that as the resection was partial and the periosteum and portions of the bone remained, the reproduction of the bone was very rapid, and although this is a very good precedent for not making the application of the appliances permanent, still in treating these cases we have to contend with the enormous resistance of the cicatricial bony tissues.

Retention. Fig. 11 represents the retaining device. In making it, bands of German silver were adjusted on the four bicuspids of the side not operated upon, and after having been soldered they were placed upon the corresponding molars: then the impression and occlusion (bite) were taken in plaster, as is usually done in making an artificial crown. When the impression was properly prepared, with the bands in their respective positions, an articulating model was made of plaster and sand, which is seen in the photograph, after the same method which is followed in making crowns with cusps and bands.

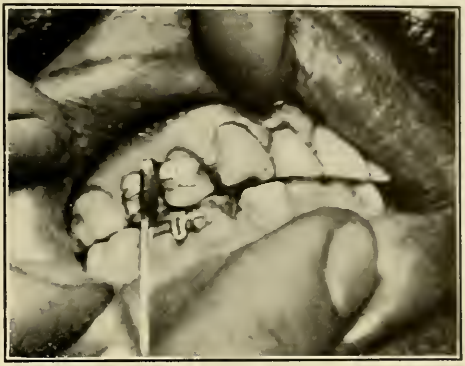

FIG. 14.

This cast was used in soldering together the bands of each piece, and for the purpose of fixing projections on them which would oblige the patient to close his mouth in normal occlusion. On the upper piece we observe on the palatine surface a projection about one centimenter in length, which protrudes beyond the surface of occlusion, it starts from between the two bicuspids and goes in a downward direction to meet the lingual surface of the lower piece, its thickness and shape being designed to accomplish the purpose in view. On the buccal surface of the same piece there is seen a piece of wire the extremities of which are fixed to the two crowns, and in its center it is bent so as to form a little hook, opening upward. The two bands, the projection and the exterior hook, are firmly strengthened and joined with silver solder.

The lower piece has a 16-gauge plate of German silver on its lingual surface, embracing the space included between the linguo-occlusal edge and the neck, and from the mesio-lingual angle of the second pre-molar to the disto-lingual angle of the second pre-molar, its principal object being to receive the projection of the upper piece. On its buccal surface it has a small wire bent in such a way that it both connects and strengthens the bands, and it also forms a small hook opening toward the gingivo-buccal fold. As in the upper piece, all its parts are solidly joined with silver solder.

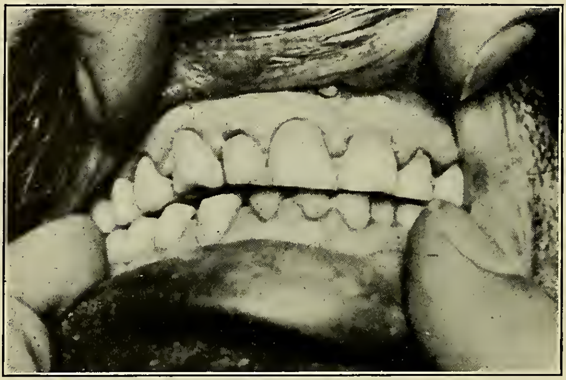

Fig. 15.

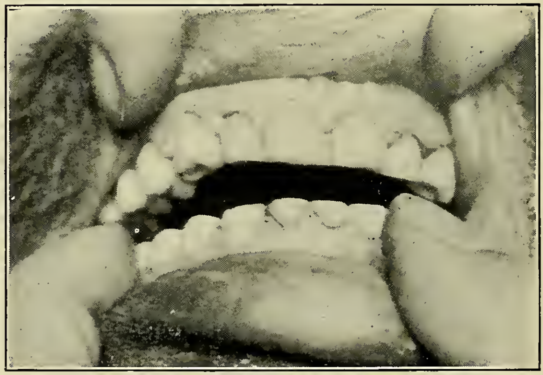

Fig. 15.

Fig. 12 shows the retaining apparatus already trimmed and polished and ready to be cemented upon the respective teeth. These devices should be very strong and well finished, so that, although it may be necessary to wear them a long time, they shall neither break nor have any injurious effect upon the teeth with which they are in contact; besides, *an alloy of gold and platinum should be given the preference in their construction* to make them as convenient as possible to the patient.

Fig. 13 shows the retaining appliance properly cemented in place, and it can be observed how perfectly it maintains the occlusion. All those who have seen one of these cases must remember how strong the traction is toward the cicatricial region; notwithstanding this, in the present case the teeth, owing to their being so firmly rooted, did not suffer any displacement or accident.

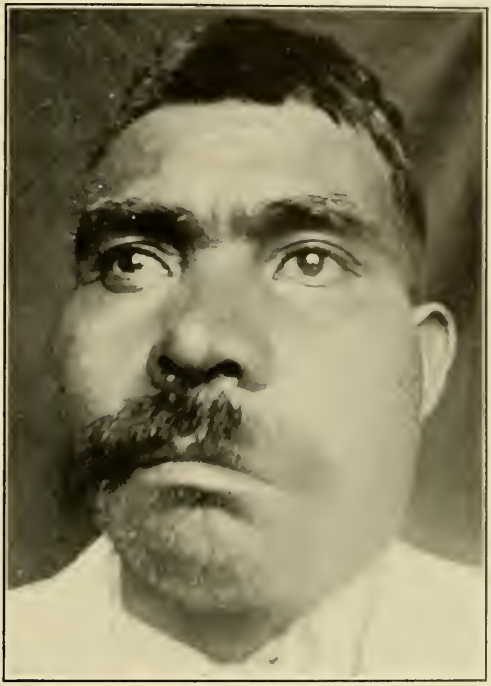

FIG. 17.

In this photograph is seen the purpose of the small hooks on the buccal surfaces of the appliance. These were put in so that a small elastic rubber band might be strung from one to the other and worn by the patient, especially at night when his will-power can not help him to keep his mouth in its normal relations. To facilitate the placing of this small band it was threaded with a piece of thread, which served the purpose of a kind of handle, as is shown in the illustration.

Fig. 14 shows the retaining apparatus when the mouth is open; the projection on the upper piece is also observed, with its rounded and polished edges.

After this appliance had been worn for six months, the upper piece broke and became unserviceable, but it was immediately replaced, new bands being used and the prolongation of the broken piece utilized, and having been slightly reinforced and cemented in position, was worn for another nine months, making a total of fifteen months.

Fig. 15 shows the beauty of a perfect occlusion, and if we again examine the first, second and third photographs for a minute we shall observe the change that has been effected; the mastication, enunciation and physiognomy have been entirely restored, benefiting the patient both physically and morally.

Fig. 16 shows the movement of the mouth, it being observable that the teeth deviate slightly from the median line when it is open wide, but as they occlude they return to the position shown in the preceding photograph.

Fig. 17 shows the correction of the median line, and to be able to better appreciate this photograph, compare with Fig. 1, 2, and 3. The enlargement of the cheek on the operated side became considerably reduced.

The patient was examined a year after the retaining appliance had been removed, lack of time preventing the taking of a photograph, but his teeth were in perfect normal occlusion, and his physiognomy symmetrical, especially as he had grown a beard.

In the course of my practice I have treated seven cases similar to this, and although all of them have shown marked peculiarities, I have followed the same principle as in this case, that is to say, the reduction of the displacement, applying the regulating force from the maxilla to the mandible; and retention, making use of the maxilla.

It gives me great satisfaction to be able to state that in recent years some of the most prominent surgeons in our city have not forgotten that the dentist can cooperate with them in cases involving major surgery of the maxillæ. A patent proof of this is that I have a case which was sent to me by Dr. Francisco de P. Bernáldez, dean of the National Dental School and an eminent surgeon, to be treated for a lesion of the mandible before the students of the said school, the result being a complete success which was gratifying to all who observed the case. It is to be hoped that these cooperative relations between physicians and dentists will increase from day to day and benefit suffering humanity.

A Consideration of the Temporo-Mandibular Region.

By S. Merrill Weeks, D.D.S., Philadelphia.

The subject to which I am now asking your consideration is one which I believe should receive more careful thought not only among those who are specializing in orthodontia, but among all members of the medical and dental professions.

Thus far it has received but enough attention to show that there is a wide difference of opinion, or no opinion at all, among the members of the dental profession.

So far as I have been able to ascertain, the attention was first directed to the subject by Dr. Kingsley not far from the year 1870. At this time he calls attention to the treatment of two cases, one of Class II, Div. I, and another Class III. Regarding these cases he speaks of changing the position of the condyle in the glenoid cavity.

These observations of Dr. Kingsley's do not seem to have made a profound impression on the minds of the dental profession. I have been unable to find other references made to the matter, or a concurrence of opinion among dentists.

Within the last year or two Dr. Howe, of Boston, has presented to the profession the reports of several cases, the treatment of which, to his mind, involved changes in the temporo-mandibular articulation. More recently Dr. McDonald, of Chicago, in an article in the *American Dental Journal* calls attention to the changes in the glenoid fossa during its progressive stages of development. At the present moment I know there are members of our profession who hold pronounced and widely varying opinions on the subject. While this condition of judgment exists I contend that a careful and earnest presentation of facts relative to this articulation and a similar discussion of the same will be useful to our members.

The importance of reaching correct conclusions in the relation between tooth movements and this joint can be doubted by no one. It is important from several aspects in determining the etiology of those cases denoted as Class II and Class III, in which the relation of the teeth of the lower arch to the upper is either mesial or distal to normal.

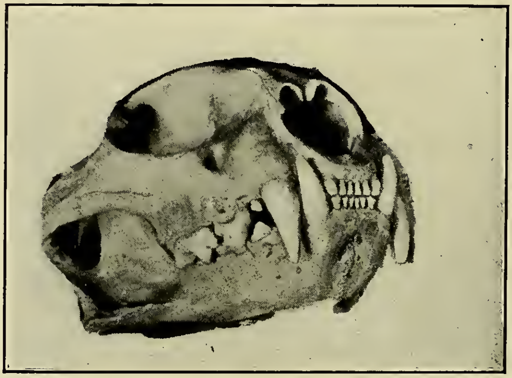

Fig. 1.

Fig. 1.—Showing the occlusion which is responsible for the peculiar joints of the carnivorous.

At present there is a radical difference of opinion as to the etiology, some contending that this abnormal relation is accounted for by an abnormal relation between the (teeth and alveolar) process and the mandible itself, while others are equally positive that the change from normal has taken place in the temporo-mandibular articulation.

Again, it is most important in the consideration of the facial aspects as associated with and influenced by the dental relation existing in the two classes of cases referred to.

If we preclude the possibility of any deviation in this joint we must conclude that so far as the lower portion of the chin is concerned there can be but slight variation from the normal in the profile.

Another phase which we must consider as most important is that of the correction of the abnormalities contained in these two classes.

The treatment and the results obtained are widely divergent, depending upon the position from which we view these cases.

In the consideration of this question it is necessary to have a clear conception of the parts concerned in this joint and their relation to each other, both in their action in performing their function of mastication, and in their relation during the different stages of development.

Joints in general anatomy are developed and the final character determined by the kind of motion which has been indulged in through the life history of the animal in question. Furthermore, the anatomy of the joint undergoes changes in development as the motion undergoes changes in the life of the animal.

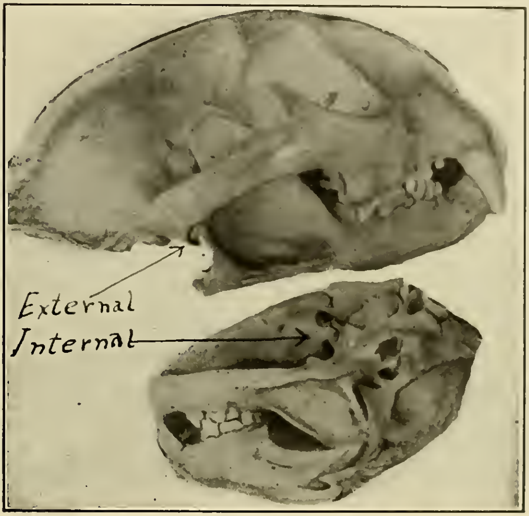

FIG. 2.

Fig. 2.—Showing the two views of the temporo-mandibular articulation of the carnivorous.

The temporo-mandibular articulation is capable of, perhaps, the greatest variety of movements of any of the articulations, and has a great many variations in the different animals, being dependent upon their habits and customs in acquiring and masticating their food.

A consideration of many of these classes and individuals, showing how the joints are influenced and determined by the habits and customs would not only be interesting, but instructive. However, the time in this case will not permit, and I shall have to content myself with a few typical and interesting examples.

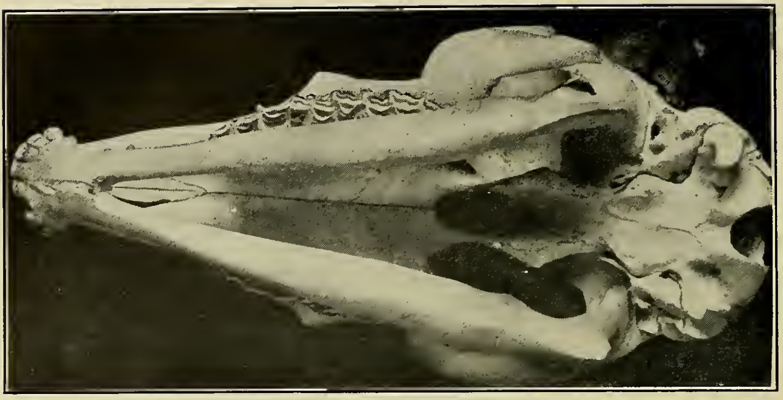

Fig. 3.

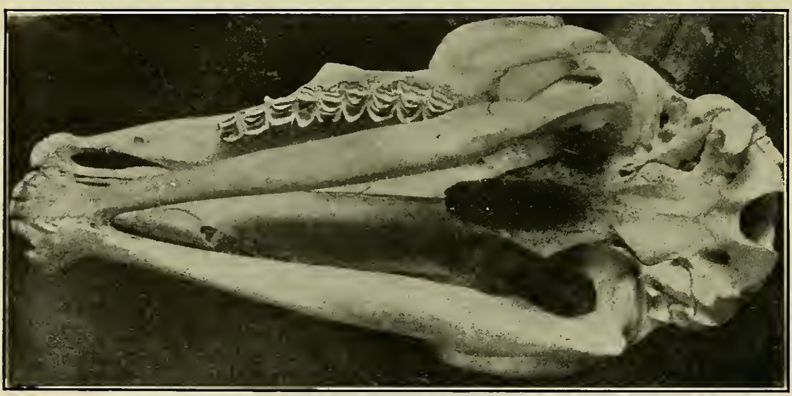

Fig. 4.

Figs. 3 and 4.—Showing the occlusion and temporo-mandibular articulation of the herbivorous.

Taking the three great classes of animals, the carnivorous, herbivorous and omnivorous, we shall see that the carnivorous is capable of the least motion; this because of the character of the food and the teeth that are supplied to prepare it for assimilation. As an example of the carnivorous we will consider the masticating mechanism of a tiger. You will see that the occlusion of this animal would preclude the possibility of any, or of but very slight lateral motion, and that the joint is developed in a manner compatible with those conditions. Other carnivorous animals present these conditions in varying degrees.

The herbivorous present just the reverse conditions, inasmuch as the food is of a different nature and the teeth of a different character, requiring more of a grinding or lateral motion to complete mastication. Here we find the joint instead of being simply of the hinge variety, as in the carnivorous, is more of a ball and socket variety giving a large variety of movements. Of this class the sheep presents about the best example. Another animal which presents very interesting features is the muskrat. This animal, which belongs to a large class of rodents, has very pronounced characteristics, due to the fact that the joint is called upon to perform acts of a widely varying nature. Thus we have a glenoid fossa developed along special lines to meet certain peculiarities of the animal. The act of incision is highly specialized, and for this the joint is developed to meet the necessity. The act of mastication requires a complete change in position of the mandible. It will be seen that to meet these different conditions the glenoid cavity is developed over a comparatively large area, each part designed to perform a different function.

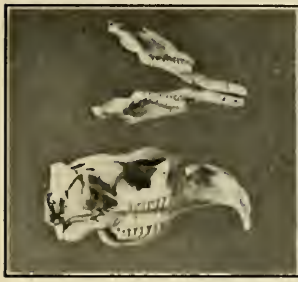
Fig. 5.

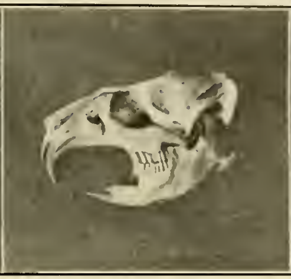
Fig. 6.

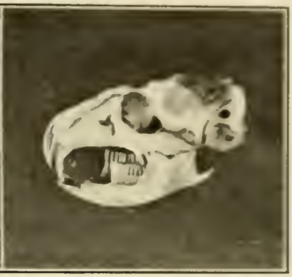
Fig. 7.

Fig. 5.—Showing the occlusion of the muskrat. The two dots in the glenoid showing the different positions of the condyle, the one during the act of incision, the other during the act of mastication.

Fig. 6.—Showing the position during mastication.

Fig. 7.—Showing the position during the act of incision.

Of the omnivorous class the genus homo will be the best and most pertinent for us to consider.

Temporo-Mandibular Articulation of Man.

In the consideration of the temporo-mandibular articulation of man it will be my purpose to take up the different parts in detail considering the osseous structure first.

Of the condyle I shall say but little as I have been able to find but little deviation; insufficient to influence the classes of abnormalities that we have under consideration

Dr. Broomell speaks of it as varying with temperaments. In any case they are very similar and change but little in general character during development, except to assume larger proportions.

In the glenoid fossa we find conditions much different, and it is here that I think we may find the key to the solution of our problem. As I have shown, the glenoid fossa is subject to many variations in different creatures; it also varies largely in the human anatomy.

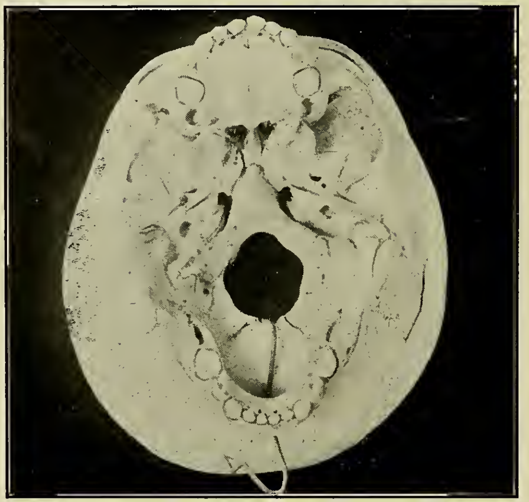

Fig. 8.

Fig. 8.—Showing the temporo-mandibular articulation of a child of four years. Note the indefinite character of the glenoid fossa.

The anterior part, the *eminentia articularis,* is formed by the anterior root of the zygomatic process, and is the most prominent portion of the fossa; from this point the fossa curves backward and upward to form the deepest portion of the fossa; from here the curve is downward slightly to the glenoid fissure; this divides the fossa in two portions; back of this is the tympanic plate which forms the osseous division between the posterior portion of the glenoid fossa and the auditory meatus.

The fossa is subject to considerable changes during development. The law of these changes can have no better expression than the example given us by Dr. Cryer in his "Anatomy of the Face":

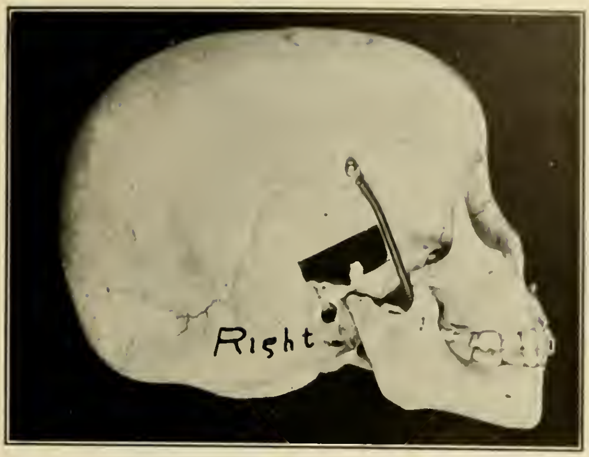

FIG. 9.

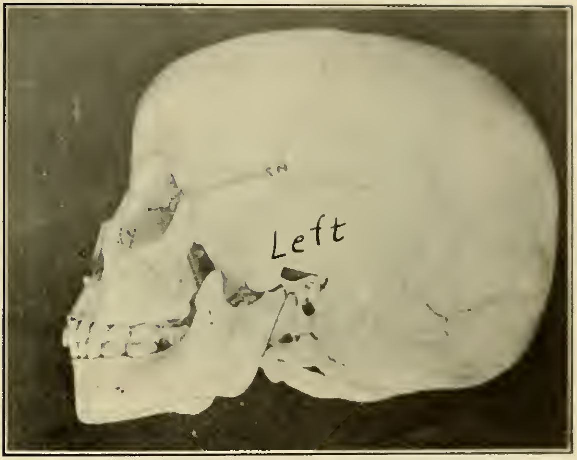

FIG. 10.

Figs. 9 and 10.—Show the glenoid cavity and the condyle cut open antero-posteriorly. It will be seen that the occlusion of the teeth on the right side is distal to normal and that the condyle has assumed a more posterior position in the glenoid fossa, while on the left side the teeth are in normal relation and the condyle rests normally on the incline of the glenoid fossa.

"If these two forces be normal—that is, properly balanced—in potential strength and application throughout life, the result will be a normally developed organism; but if these forces be interfered with in any way, by lack of nourishment or undue external pressure, the individual may fail to develop a normal physique." ("Causes of Variations in

Shape," page 141, paragraph 2.) And again, "The normal application of the forces affecting developing bone results in normal development of the form of the bone. Their abnormal application under the same circumstances results in the development of abnormally formed bone. Abnormal application of forces to the bone in adult life will also change and modify the shape and character of the bone tissue."

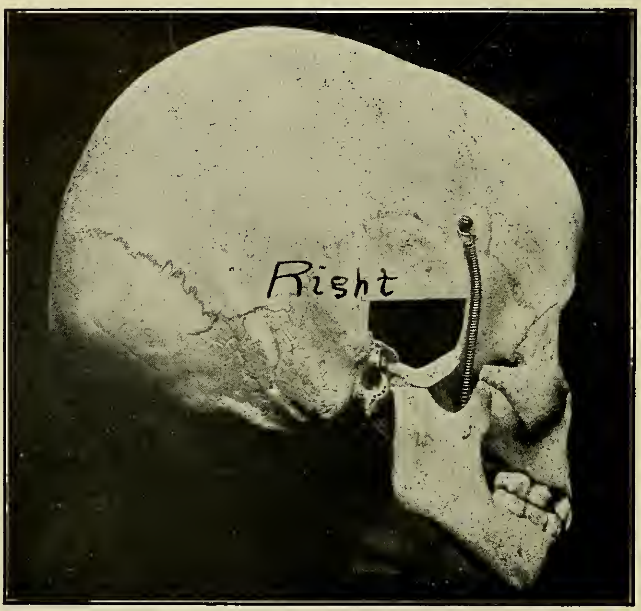

FIG. 11.

Fig. 11.—Shows the right side of the temporo-mandibular articulation in which the distal portion of the condyle is directly or nearly in contact with the tympanic plate of the temporal bone.

At birth there is but little definition, the *eminentia articularis* and the deepest portions of the fossa presenting but a slightly curved line. From this time on the development is peculiarly influenced by the position of the condyle, while the position of the condyle would seem to be influenced by the occlusion of the teeth, muscular relations, habits, etc.

I believe that the development of the osseous structure of the glenoid fossa is determined along the lines of the least resistance, and as the greatest resistance would be at the point of contact of the condyle, we would have developed here the bone of a more dense character, while at the other position away from the point of extreme pressure, we would

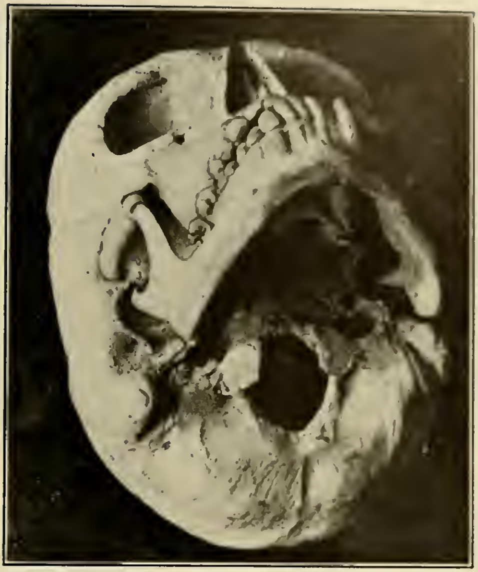

FIG. 15.

Figs. 15 and 16.—Show how the occlusion of the teeth may be responsible for abnormalities in the formation of the temporo-mandibular articulation. It will be seen that on one side the occlusion of the teeth has been such as to allow for a considerable amount of lateral motion, thus causing the glenoid fossa to be large and indefinite in nature, while on the other side the occlusion has been more definite, causing the temporo-mandibular articulation to form in a definite manner, as is usual with subjects of advanced years.

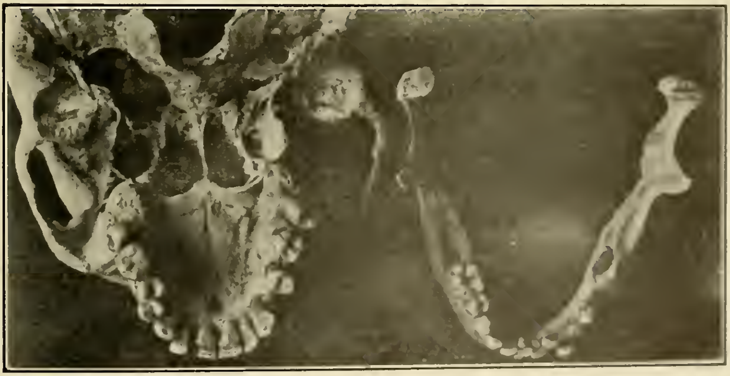

FIG. 16.

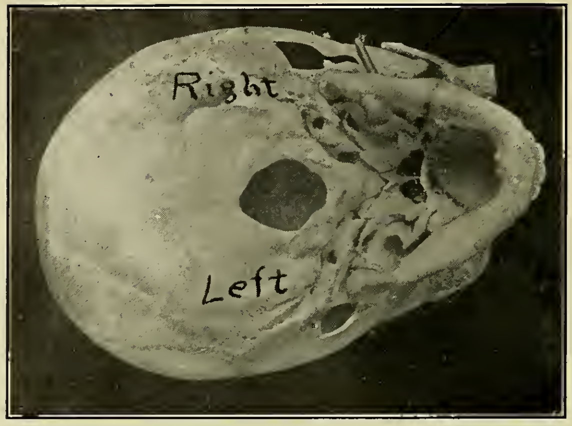

Fig. 12.

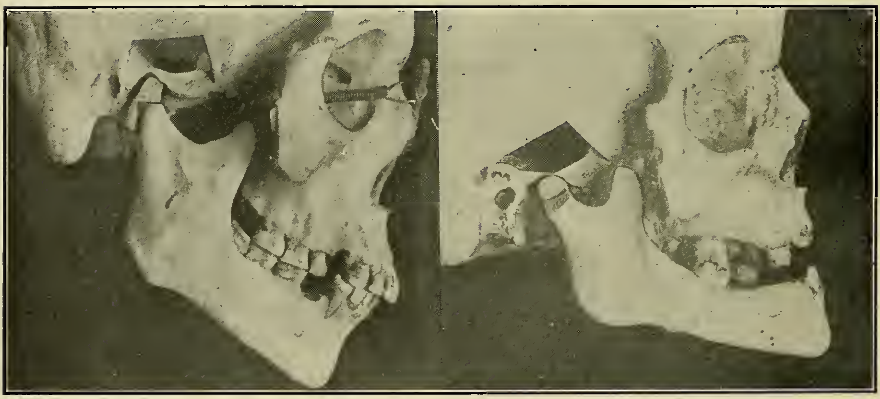

Fig. 13. Fig. 14.

Fig. 12.—Shows a different view of the same condition.

Figs. 13 and 14.—Show cross-section of the temporo-mandibular articulation in which, when the teeth are in normal occlusion, the condyle rests considerably anterior to the deepest portion of the glenoid fossa.

have bone of greater bulk, but of less density. In this way it would seem that the development of the glenoid cavity is dependent upon the position of the mandible.

I wish to ask here your particular attention to a consideration of the articulating cartilages, which, I believe, are of even *more* importance in determining the position of the condyle. Of these there are two varieties; the hyaline type covers and is attached to the articulating surfaces of the joint. The other surface is covered with a fibrous membrane which in turn is covered with the synovial fluid. This cartilage is of a general nature and undergoes no great change during the development to maturity and old age except, perhaps, to become thinner and more dense. The character varies but slightly, if any, over the entire surface. This, therefore, we may put down as invariable.

Interposed between these surfaces we find the interarticular fibro cartilage. Between it and the cartilage covering the articulating surfaces of the bone on either side we have a sac containing the synovial fluid. The interarticular cartilage has its attachment at its boundary to the capsular ligaments.

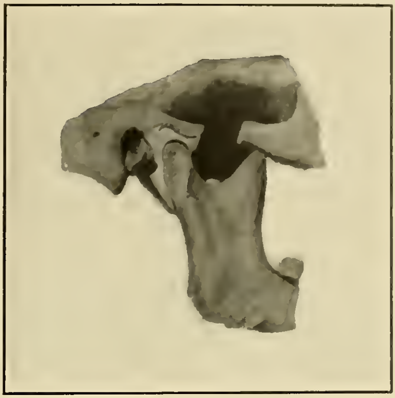

FIG. 17.

No. 17.—Shows diagrammatically how the inter-articular cartilage acts to help sustain the condyle along the upward incline of the glenoid fossa.

The character of this interarticular cartilage is varied. In childhood it is thick and yielding, which would make it easily susceptible to influences; on the one hand existing to guide it to assume normal relations; on the other, requiring but little to cause the condyle to rest in a malposition in the glenoid fossa.

It will be noticed that the condyle in normal cases does not rest as we might expect it to, in the deepest portion of the glenoid fossa, but at some point along the incline toward the *eminentia articularis*, the point doubtless being determined by such factors as the occlusion, condition of the ligaments and muscles.

The fact that it may be retained in this position must be acounted for in part by the varying thicknesses of the interarticular cartilage, these varying thicknesses being established by the pressure of the condyle; being the thinnest at such point as the pressure is continued for the greatest length of time.

The capsular ligament is doubtless another factor in sustaining the condyle in its position on the upward incline of the fossa inasmuch as the posterior portion has its attachment above the glenoid fissure, and with some portions of the parotid gland, occupies the space between the posterior part of the condyle and the tympanic plate. However, during the formative period of this joint all of these soft tissues would be easily subject to outside conditions.

That the joint may be influenced by external conditions during maturity can be shown by the examination of skulls showing a considerable variation in the shape of the fossa and in the amount of motion, of which the condyle would be capable.

With these factors in mind, and in conclusion, I wish to ask your consideration of these points:

First. That the relation of the parts concerned in the formation of the temporo-mandibular articulation is of such an indefinite nature as to afford the point most easily influenced by the abnormal relation in occlusion, in habits, in mouth-breathing and in traumatisms, etc.

Second. That the deviations in facial lines are of such a nature as to be accounted for only by malrelations of the mandible as a whole.

Third. That in the correction of these malformations we fail very greatly in producing the best results if we disregard the possibility of changing the mandible as a whole, because the movement of the teeth and alveolar process alone will produce almost no change in the point of the chin, where there is the greatest need of improvement.

Discussion of Paper by Dr. Weeks.

Dr. Matthew Cryer. It gives me much pleasure to open this discussion on "A Consideration of the Temporo-Mandibular Region," and through the permission of your officers and Dr. Weeks, I will introduce a few other points not alluded to by the essayist. It has been said by a high official of one of the great universities that what is wanted in the President of the United States is a man who will think before he acts. I agree with him, and wish to say that an orthodontist, as well as any other man, should think before he acts; without this attribute the orthodontist will do more harm to the individual patient than a President can do to the United States. When

I wrote the paper on "Typical and Atypical Occlusion of the Teeth in Relation to the Correction of Irregularities," it seemed that sufficient consideration was not being given to the various anatomical, physiological and pathological conditions, and also to the general health of the patient. I was glad to find that the discussion of the paper not only proved that there were thinking men who were interested in scientifically correcting irregularities of the teeth, but it also proved that there were others who did not "see all around the circle" of this important subject—those who thought part way and jumped at conclusions for the remainder.

In discussing the question of a consideration of the temporo-mandibular region it is, of course, necessary to consider the relation of the mandible to one of the most important bones of the cranium—the temporal. This bone forms a portion of the base of the brain case; it contains a canal through which the carotid artery passes to supply the greater portion of the brain and the eye. In the posterior portion of the bone is a great groove for the lateral sinus, which accommodates the outflow of blood. The nerve of facial expression passes out through a tortuous canal in the temporal bone. The organ of the special sense of hearing is located in close juxtaposition to the condyle of the mandible. The mandible is formed from Meckel's cartilage, from which the ear bones develop; in fact it is a continuation of the malleus in early embryonic life.

From the data shown by Dr. Weeks, and others to which I shall direct your attention, will be demonstrated the necessity of considering the structures associated with the temporo-mandibular articulation, before undertaking to change the relations of the two bones entering into it. You will see at once that I am committed to a belief in the affirmative of the main question before us, as to the possibility of changing the relations of the bones entering into the temporo-mandibular articulation; but, while accepting the general truth of that fact, I wish to be clearly understood as to my position with regard to the limitations, which, in my own judgment, qualify the extent to which such changes of relation may conservatively proceed. A forward placement of the jaw, I think, can be accomplished with less risk than a backward placement. Slides made from specimens will be shown in which the tympanic wall has not been formed, and others where it has been lost through disease. In such cases a retro-placement of the mandible by any of the mechanical orthodontic means known to me, would, in my opinion, be attended with serious risk to the life of the patient. If all skulls were typically normal, there would be no necessity for orthodontists of any school—not even of the "new school," except in case of accident, as in such skulls the teeth are in typical positions. But, fortunately for the orthodontist, many skulls are not typical, and as a general rule the teeth are not in typical, nor in functionally correct positions. If this be accepted, and we wish to bring about changes, it stands to reason that we must deal with problems that go further back than the question of the positions of the teeth, in order to correct them judiciously. We must go back to embryonic life, and study the various phases from that time onward.

The author of the paper has drawn our particular attention to the temporo-mandibular articulation. Therefore, in justice to him, we will endeavor to keep close to a study of that region. He has shown us the anatomical condition of this articulation at the time of birth and at other periods; also, some comparative anatomy. When asked to discuss this paper, and I was told by the chairman of the Executive Committee to bring all the slides I wished. I made a selection of a number of skulls, and have made slides from them. They include skulls of individuals from the time of, or before, birth, up to old age, and also a few of the lower animals.

In the mammalian the articular surface of the condyloid process of the mandible is convex; in all other vertebrates it is concave, articulating with the convex surface of what corresponds to the glenoid cavity in mammals. The portion of the skull with which the mammalian mandible articulates—the glenoid cavity—is generally concave, as in man, though there are great variations. In the rodents it is groove-like anterio-posteriorly. In the hog, and animals closely related to it, the condyle articulates upon the *eminentia articularis* instead of in the glenoid cavity. If the temporo-mandibular articulation of the vertebrate be shown to one who has paid any attention to the occlusion of the teeth in relation to this joint, he can readily tell the character of the teeth, and the nature of their occlusion. Conversely, given the occlusion of the teeth, he will be able to classify the animal and give the character of the temporo-mandibular articulation.

Changes in Articulation of the Mandible.

At one period of life the articulations of the vertebrates are very similar to each other. As life advances the similarity disappears, conditions changing in proportion to the environment and character of the food. If the articulation of the mammalian type alone be studied great variations will be found. Time will only permit mention of a few. Slides of the human subject will demonstrate how flat the glenoid cavity is about the time of birth, and that there is but little change until the time arrives for the child to eat meat; then it changes rapidly until puberty. As old age comes on the articulation again changes and becomes more like that of childhood. In the ruminant animal the glenoid fossa at birth is flat, and deepens but slightly with advancing life. In the carnivora, the glenoid cavity at birth is comparatively flat, but begins to deepen early as the animal soon becomes a meat-eater. In the omnivora this cavity changes in relation to the character and food eaten. In those animals living entirely on meat the glenoid fossa is deepest, and the anterior and middle roots of the zygoma grasp closely more than half way round the condyles of the mandible, rendering it impossible to disarticulate the bone.

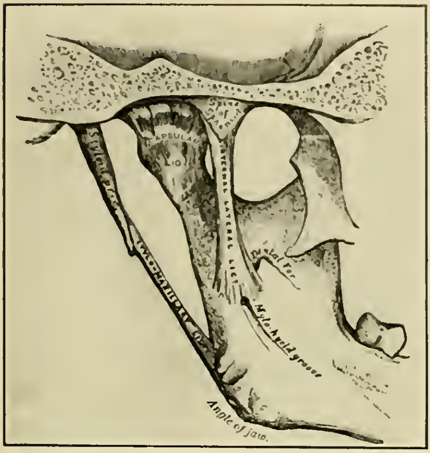

Fig. 1.

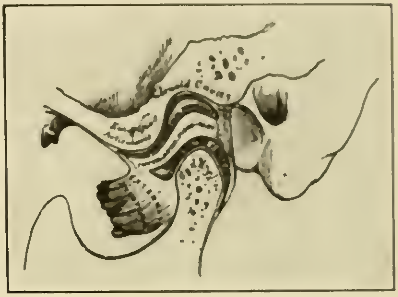

Fig. 2.

With this introduction we will take up the slides for a more graphic portrayal of the many adaptations of the temporo-mandibular articulation to the varied functions it is called upon to perform in relation to the food habit of the individual.

Those who wish to prepare themselves for any special work in medicine or surgery, are usually compelled to commence again the study of special anatomy, physiology and pathology. For the reason that many teachers of these branches are not practical men, and the books on these subjects are too often written by men who do not practice, they run into ruts and follow each other blindly, often without doing any original research. Take, for example, the illustrations Figs. 1 and 2, taken from "Gray's Anatomy," of the Temporo-Mandibular Articulation, now under discussion. They show erroneous anatomy and are misleading, if the student is not made to understand they are, at best, nothing more than diagrams, and when thus studied become useful. These two figures give a general outline of the articulation, the bones, the ligaments, etc.; but

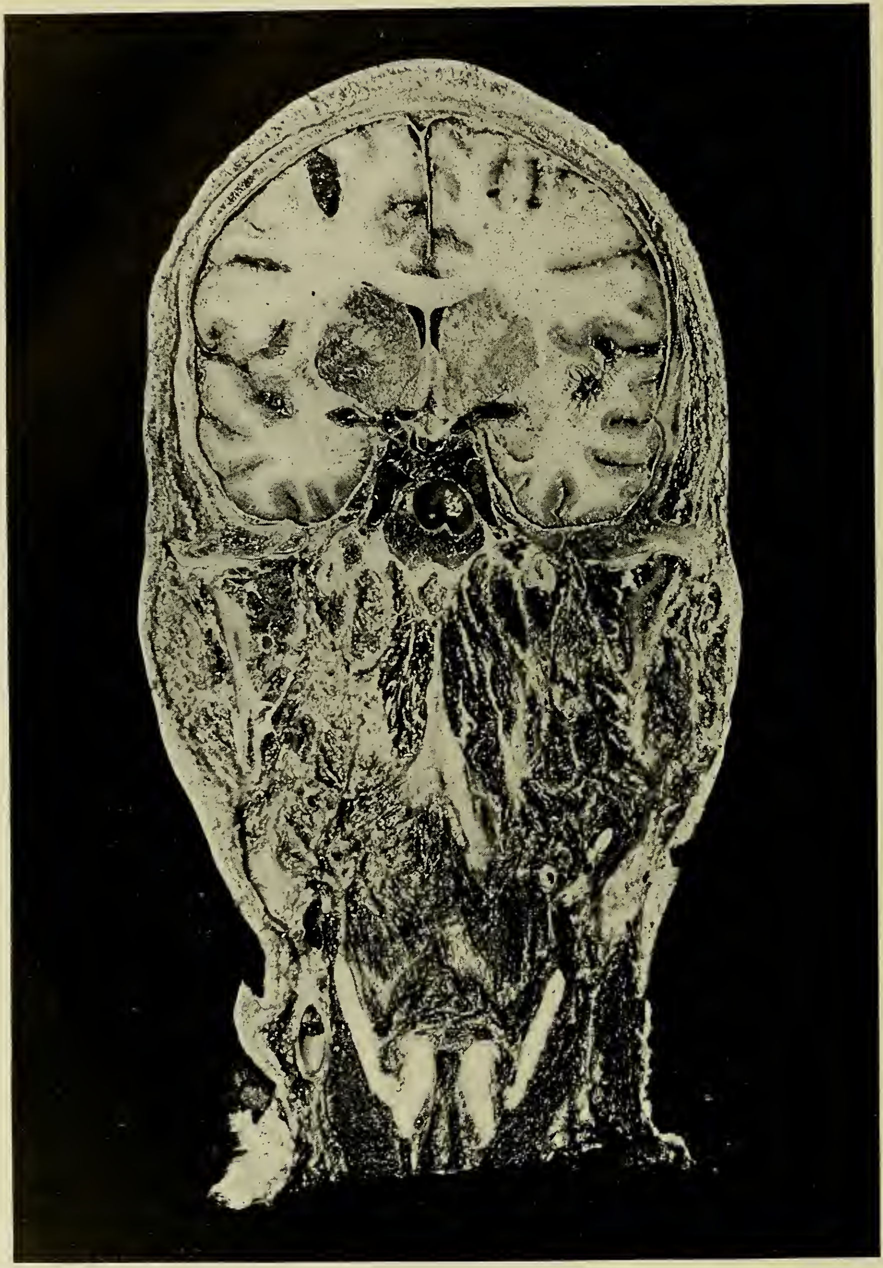

FIG. 3.

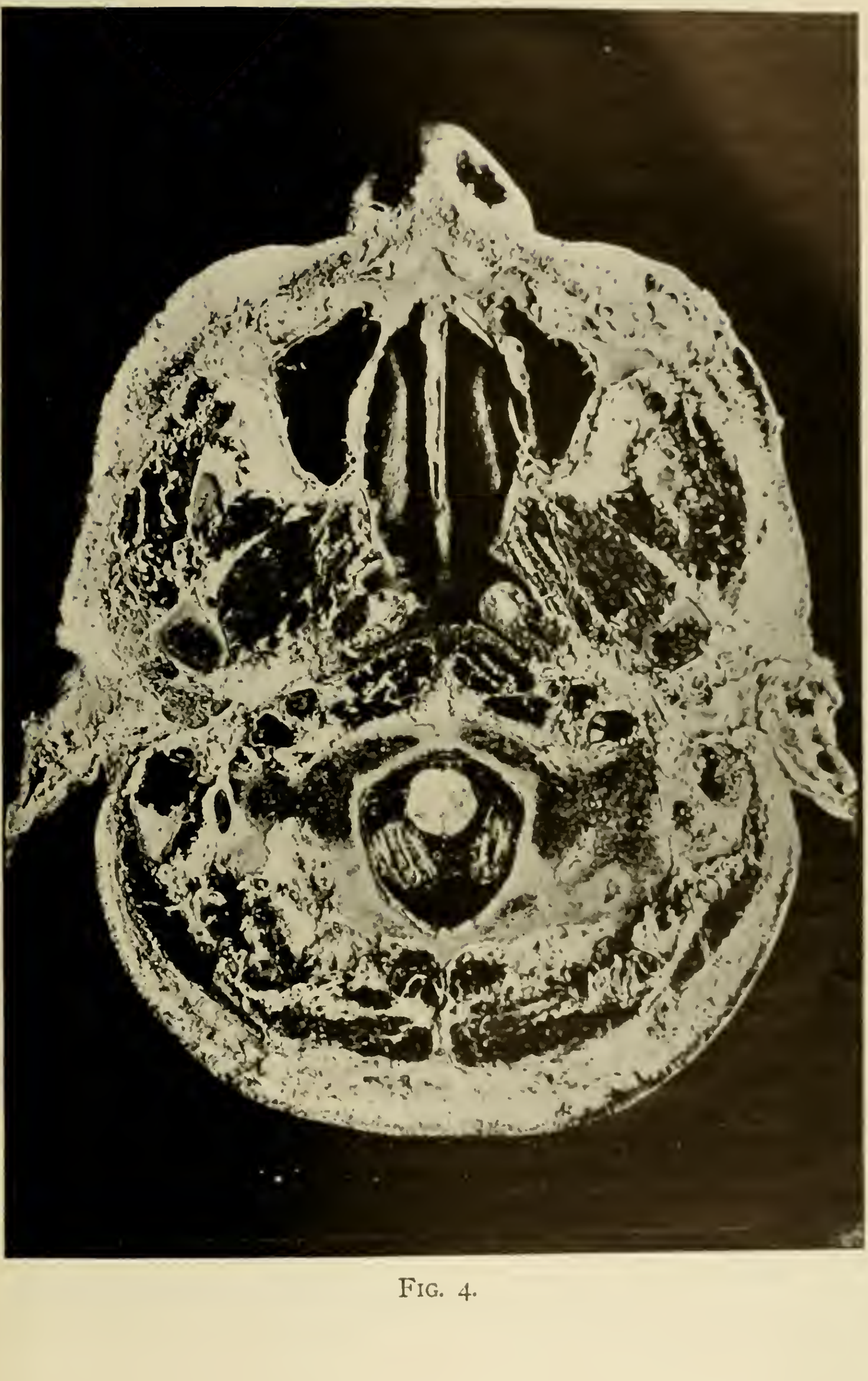

FIG. 4.

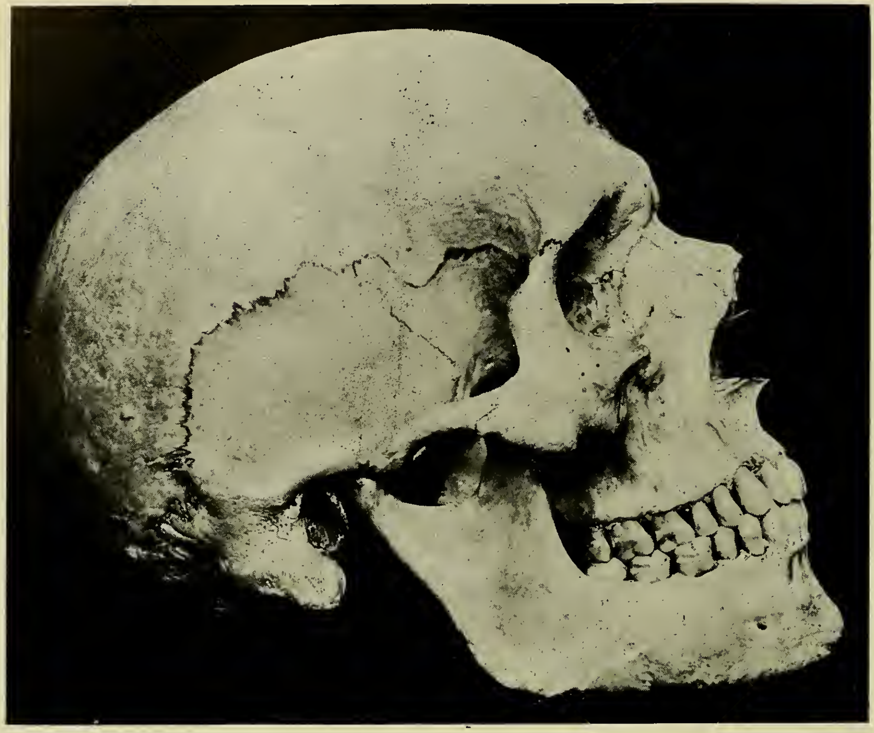

FIG. 5.

the relation of one tissue to another is false, consequently misleading. If these diagrams are used in order to become familiar with the names of the parts, or to talk of anatomy blindly to a student, or a member of an examining board, well and good; but the moment one undertakes surgical operations, whether intending to cut into the parts or change the relations of these structures with one another by any surgical operation or mechanical appliance, then diagrammatical knowledge is worse than useless.

To give a comparison between diagrammatical anatomy and that found in the cadaver soon after death, Figs. 3 and 4 are shown.

Fig. 3. Fig. 3 is made from a photograph of a vertical transverse bilateral frozen section, cut through the glenoid fossa of each side. The heads of the condyloid processes are shown in true relations with the glenoid fossa and other surrounding tissue.

Fig. 4. Fig. 4 is made from a photograph of a horizontal frozen section, cut through the head of the condyloid process of both sides. It shows the attachment of

the external pterygoid muscle and other tissue within and surrounding the glenoid fossa.

The anatomy, the physiology and the pathology of the living subject, as nearly as possible, must be studied. In this discussion I will begin with the skull, as it is the framework upon which depend the form, the character and, to a great extent, the movements of the face.

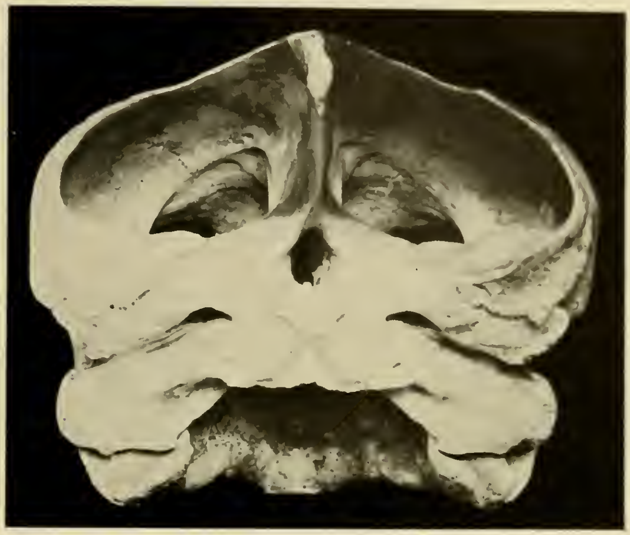

FIG. 6.

Fig. 5. Most of you are familiar with this skull as illustrated in Fig. 5; it has been discussed and rediscussed. It is a typical skull of a white person. The position of the condyle in relation to the glenoid fossa is about normal, and the space between the bones in the living subject is filled by various structures such as hyaline cartilage, synovial-membrane, the inter-articular fibro-cartilage, the blood vessels, etc. The teeth are in good occlusion and alignment; you would all be pleased to get such results from your treatment of malocclusion. One of the reasons for showing this specimen at this time, is to draw particular attention to the relation in a typical skull, of the articulation with the external auditory meatus. The glenoid fossa is usually described as situated under the base of the zygomatic process, bounded in front by the anterior root of the zygoma, posteriorly by the auditory process. It is this latter process to which I would like to draw your particular attention. It is a thin bony

partition between the glenoid fossa and the ear, and in many skulls there is but slight space between the condyle and this thin lamina of bone. It stands to reason that if any interference should be brought about which would cause the condyloid process to be carried backward either by surgical operation or mechanical appliance, absorption would likely take place. In the collection of skulls at the Dental Department of the University of Pennsylvania, several specimens can be shown in which the auditory process has been reabsorbed, causing the external auditory meatus and the glenoid fossa to become one cavity. Before taking up the development and the growth of the surrounding tissue of the temporo-mandibular articulation, it may be well to give a little comparative anatomy of this joint. I have already said that in the mammalian the articular surface of the condyloid process of the mandible is convex; in all other vertebrates, which includes the birds, reptiles and fishes, it is concave.

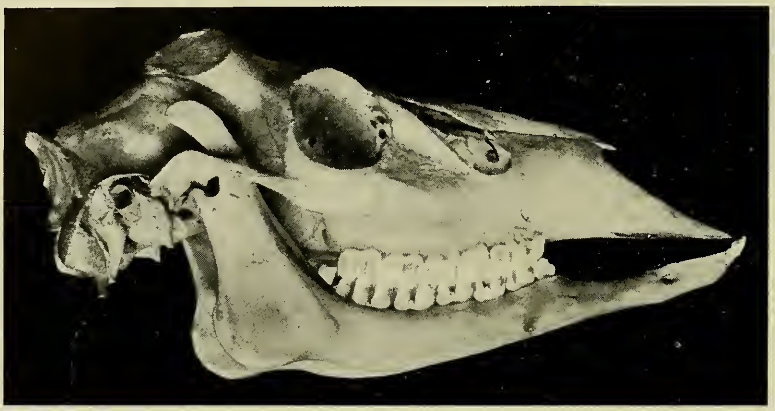

Fig. 7.

Fig. 6 gives a posterior view of the head of a
Fig. 6. large sea-turtle. In many of these three classes of animals spoken of, the concavity of the condyloid process is more marked than in this specimen. In the ruminant animal, such as the deer, the sheep and the ox, the temporo-mandibular articulation has the greatest freedom of movement, consequently the glenoid fossa is very shallow and changes but little throughout life.

Fig. 7. Fig. 7 gives a lateral view of a deer's skull.

Fig. 8 gives the under-surface of the same with
Fig. 8. the mandible removed. It will be noticed how flat the glenoid cavity is, allowing great freedom of

movement of the mandible in the ruminating action which is required to masticate the food. The articulation of the rodents gives a rather free movement as the teeth have two special functions, one of mastication, with the grinding teeth, and of gnawing, with the incisors. On general principles, however, there is but slight lateral movement. The change of the relation of the process within the glenoid fossa or groove is antero-posteriorally; the condyle moves forward or backward, usually upon the same plane, which allows the grinding teeth to work independently of the incisor. In some cases when the incisors are brought into action the condyle has to be lowered in the glenoid fossa, in order that the incisors may come into contact with each other and at the same time contact of the grinding teeth is avoided.

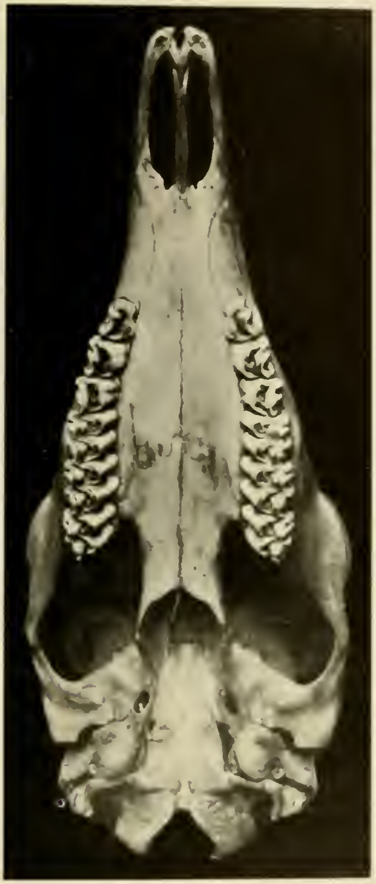

FIG. 8.

Fig. 9.

Fig. 9 is made from the under-surface of a skull and the upper-surface of the mandible of an African porcupine; it shows the occluding surface of both jaws, the groove-like glenoid fossa of each side, and the condyloid process of the mandible. By examination of the grinding teeth of the three specimens of the rodents, these will be found to vary to a great extent, one class being suited to one class of food, another, to another class of food.

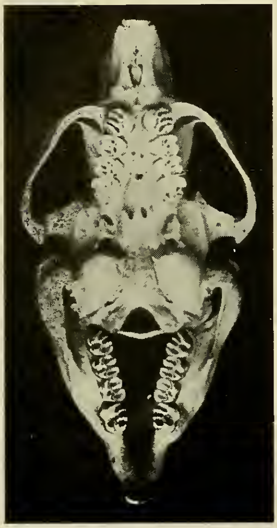

FIG. 9.

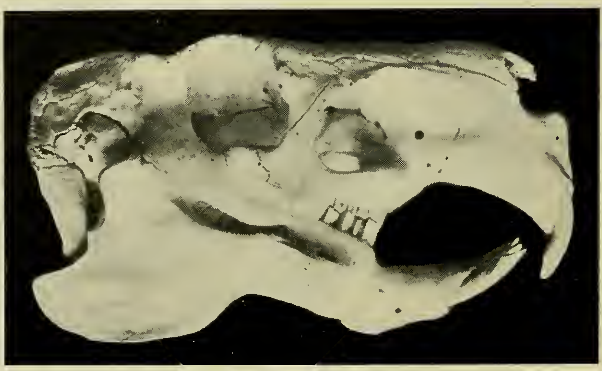

FIG. 10.

Fig. 10.

Fig. 10 is a side view of the head of the *Hydrochoerus Capybara,* the largest rodent now living. It is of tropical America; the animal grows to the length of over three feet, and, as its name implies, is a water-loving animal. It will be noticed that when the grinding teeth are in occlusion the lower incisors are considerably posterior to the upper incisors. (I suppose I should say to this society that they are "distal" although really they are nearer to the center of the body.)

Fig. 11.

Fig. 11 is an under view of the same skull as Fig. 10. Notice the length of the glenoid (groove) fossa. The make-up of these teeth should be very interesting to all of us; they are formed of enamel plates, somewhat on the plan of the elephant, though the cement substance only binds the center of the plates, leaving knife-like edges on the lingual and buccal surfaces. The articulation allows but slight motion, but its antero-posterior (mesio-distal) motion is great. It is an animal that lives on vegetables entirely and it is claimed that "its curious teeth are needed in order to bruise the herbage on which it feeds into a mass sufficiently pulpy to enable it to pass through a very narrow throat."

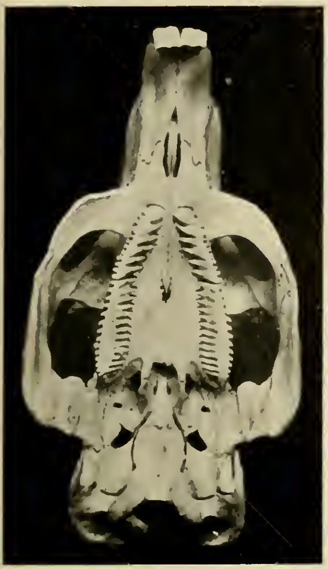

FIG. 11.

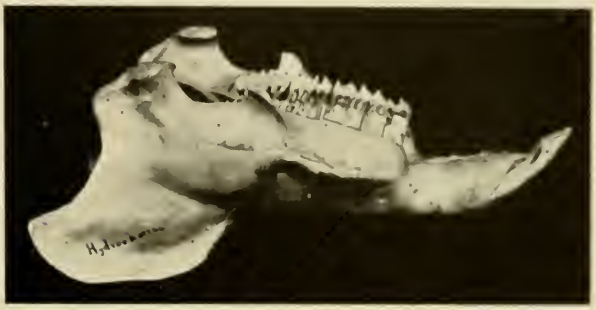

FIG. 12.

Fig. 12.

Fig. 12 gives a lateral view of the mandible of the same skull as shown in Fig. 10; it will be noticed that the condyloid process, the occluding surfaces of the grinding teeth and the cutting edges of the incisors are nearly on a straight line and that the angle of the jaw extends backward beyond the vertical line of the condyles.

Figs. 13 and 14.

Fig. 13 is made from a side view of the North American muskrat. As in the *Hydrochoerus*, when the grinding teeth are in occlusion there is a considerable distance between the points of the incisor teeth of the upper and lower jaws, demonstrating the distance the lower incisors have to be carried forward, *not mesially,* before they can come in correct occlusion, and, in so doing, the jaw has not only to be carried forward, but in this particular specimen the condyles have to descend as well, in order that the grinding teeth do not prevent the gnawing operation of the incisors, as is well shown in Fig. 14, which is made from the same specimen as shown in

Fig 13. In this animal, there must have been a great latitude in the movement of the temporo-mandibular articulation. Thus it is shown what great latitude of movements are provided for in the ruminants and, to some extent, in the rodents of Africa and South and North America.

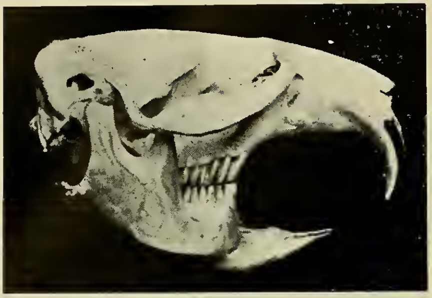

FIG. 13.

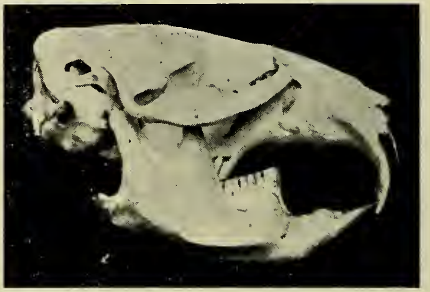

FIG. 14.

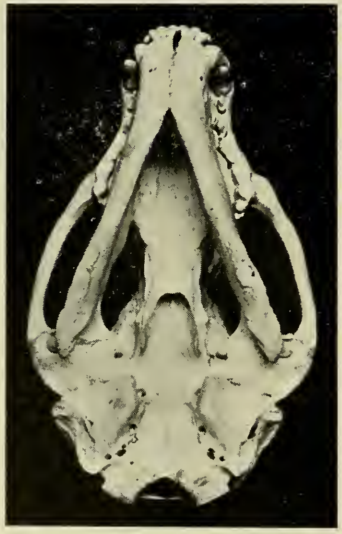

FIG. 15.

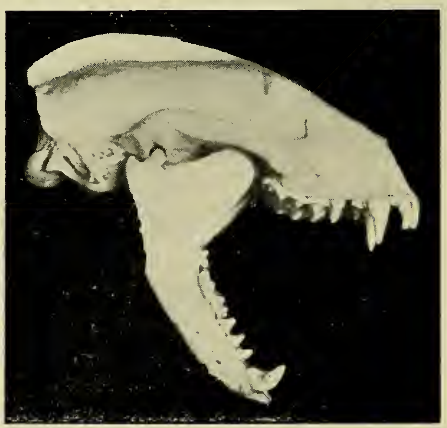

FIG. 16.

In the carnivora the temporo-mandibular articulation is contrasted strongly with that of the ruminants, as to giving free movements. In the highest type it is a fixed hinge joint with no forward or lateral movements. The highest type I know of is the badger.

Fig. 15. Fig. 15 gives an under view of an American badger's skull. It will be noticed that the condyloid process of the mandible is more than half surrounded by the anterior and middle roots of the zygoma.

Fig. 16. Fig. 16 gives a side view of the same head as that shown in Fig. 15. It is here shown how the head of the condyle is firmly grasped by the anterior and middle roots of the zygoma. Incidentally it might be said that it would be somewhat difficult or impossible to "jump the bite" where we had such an articulation.

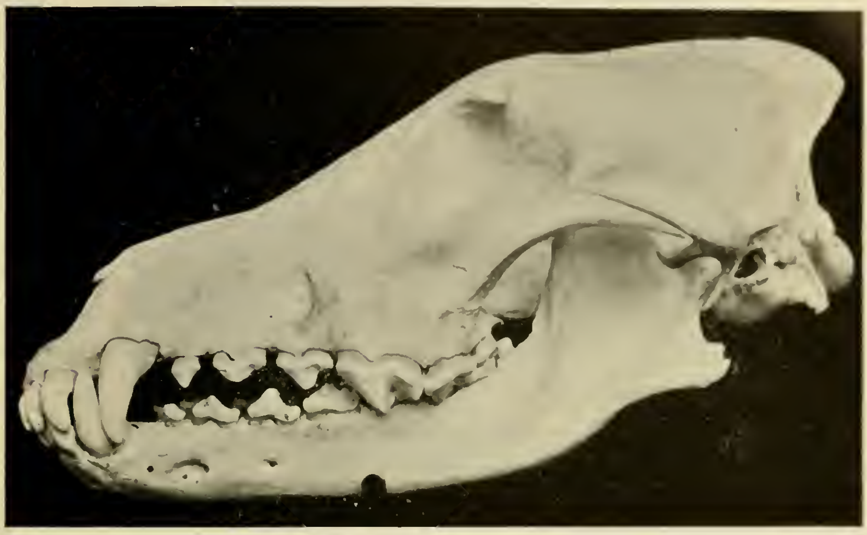

FIG. 17.

Fig. 17. Fig. 17 is a side view of the skull of the wolf. There is much more latitude of movement than in the tiger, at the same time the middle root of the zygoma extends downward, which allows some freedom of movement, but prevents a backward dislocation.

Fig. 18. Fig.18 is an under view of a wart-hog of West Africa. The glenoid fossa is very shallow, and when the mandible is in articulation with the condyloid process it rests upon the *eminentia articularis*, making two convex processes forming the articulation, consequently giving great freedom of motion. This condition is found in many other animals.

Fig. 19. Fig. 19 gives a side view of a porcarius (hog) baboon. The specimen belongs to Dr. Kirk. It will be noticed in this case that the condyloid process articulates directly upon the anterior root of the zygoma, and that the middle root passes downward, forming a guard to the condyloid process.

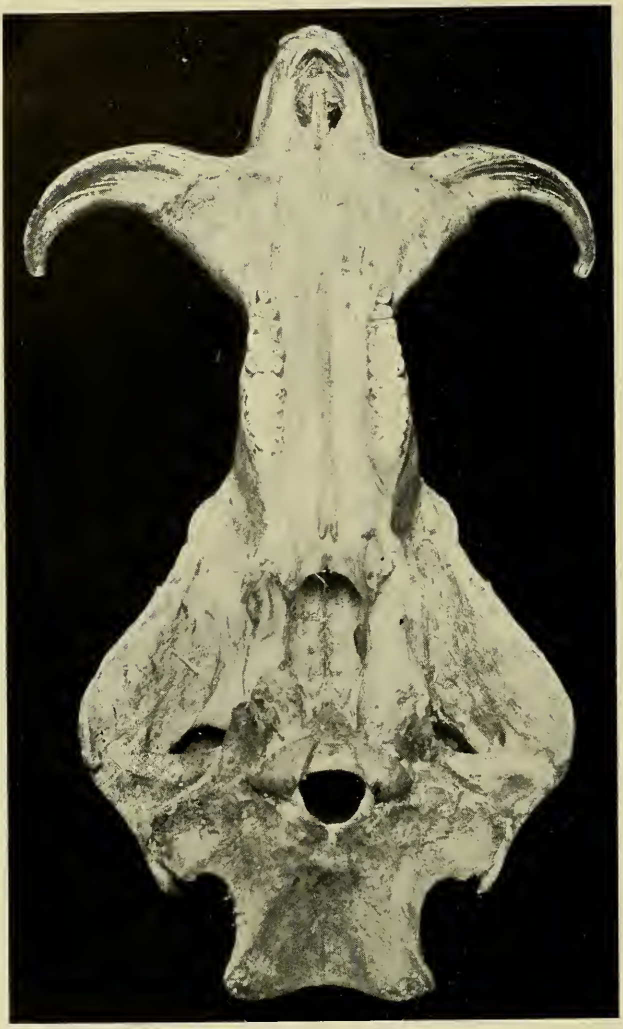

Fig. 18.

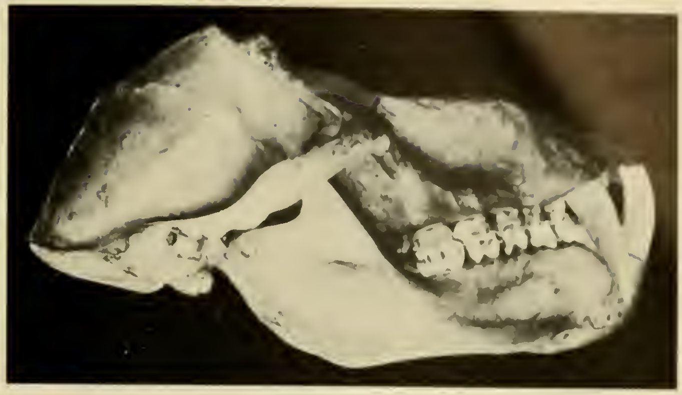

FIG. 19.

Fig. 20. Fig. 20 is a side view of the skull of a gibbon. The temporo-mandibular articulation is more like that shown in the skull of man (Fig. 5). The teeth also approach those of man; even the alveolar process shows evidence of pyorrhea alveolaris having existed. Of course, this is common in many of the lower animals.

Fig. 21. Fig. 21 is made from a side viewof a chimpanzee skull. It shows an articulation very little different from that of man. The ramus of the mandible is also similar to that of man.

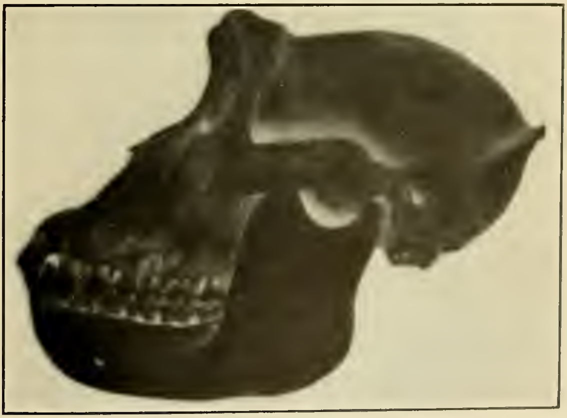

FIG. 20.

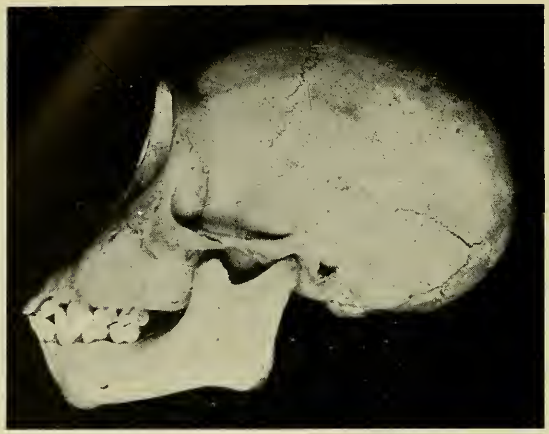

FIG. 21.

Fig. 22.

Fig. 22 is made from the under view of the same skull as shown in Fig. 21. It shows a shallow glenoid cavity somewhat similar to that of a child cutting its first permanent molar. As is shown in this specimen all the deciduous teeth are still in position.

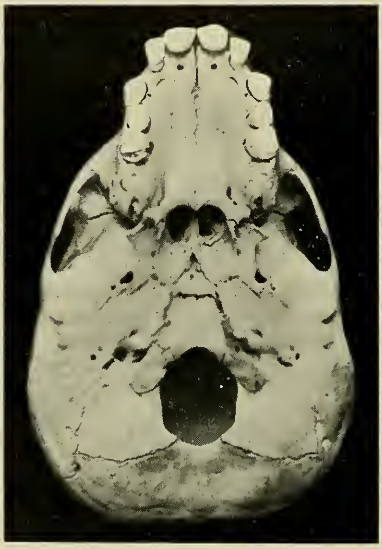

FIG. 22.

Fig. 23. Fig. 23 is made from a side view of a human skull of about the sixth or seventh month of fetal life. The mandible is suspended in the glenoid fossa which is flat and shallow, the condyles are rounded and short. Posterior to the fossa, a ring is well shown; it is the auditory ring upon which the tympanic membrane is suspended, and also upon it the greater portion of the wall of the external auditory canal is built; there is but slight change until some time after birth. Every man and woman should know what little protection the articulation and the special organ of hearing have at birth and for some time afterward. A blow upon the ear may show ill effects in after life. An inflammatory condition brought about in this region during the development of the auditory process and the glenoid fossa is, in my mind, the cause of several kinds of malocclusion; especially of a forward bite. In regard to injuries inflicted upon this region at the time of birth, several papers have been written. There is room for others. The relations of the jaws at the time of birth should be studied; of course, they will not be exactly alike in all cases, but a general average will find the lower jaw occluding within the circumference of the upper one. If the lower jaws were found on an even line with the upper or in advance of it, there would be reason to think the condyles had been carried forward from their normal position, especially if the child had been a breech presentation or had required delivery by forceps. Every *accoucheur* should understand this, and means, at the time of birth, or soon afterward, should be used to correct the misplacement.

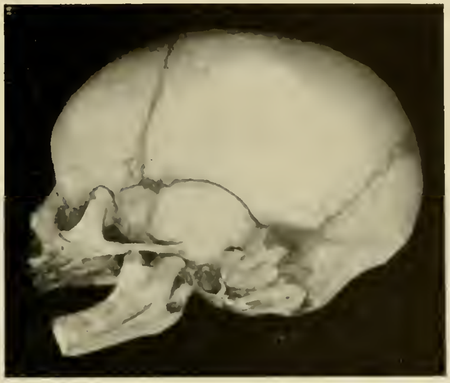

FIG. 23.

Fig. 24.

Fig. 24 is made from an under view of a human skull at the time of birth. The jaws are closed. It will be observed that the lower "bites" within the upper. The condyloid process is in close juxtaposition to the auditory process. The process is somewhat thicker than that shown in Fig. 23. The external tympanic membrane has been preserved, but has no bony protection, as will be found a little later in life.

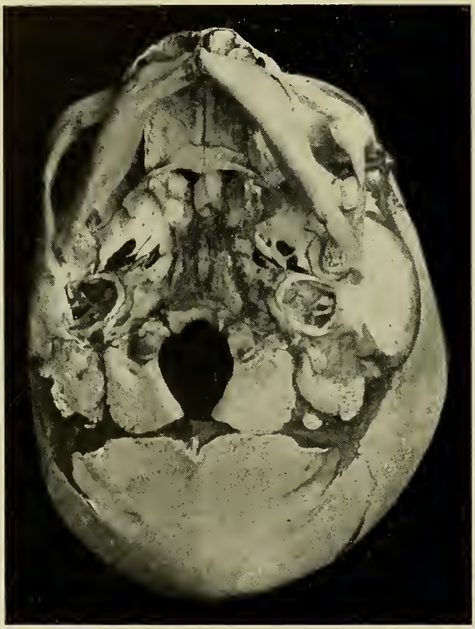

Fig. 24.

Fig. 25.

Fig. 25 is made from a side view of a child's skull, at about the age of four or five months. The deciduous teeth are causing the alveolar process to form rounded prominences over them; the condyloid process is more developed; the angle of the jaw is somewhat changed as compared with Fig. 23. The auditory process is better formed; the groove for the external tympanic membrane is well shown.

Fig. 26.

Fig. 26 is made from the same skull as Fig. 25, giving a half view of the base and side. It will be noticed how close the condyloid process is to the

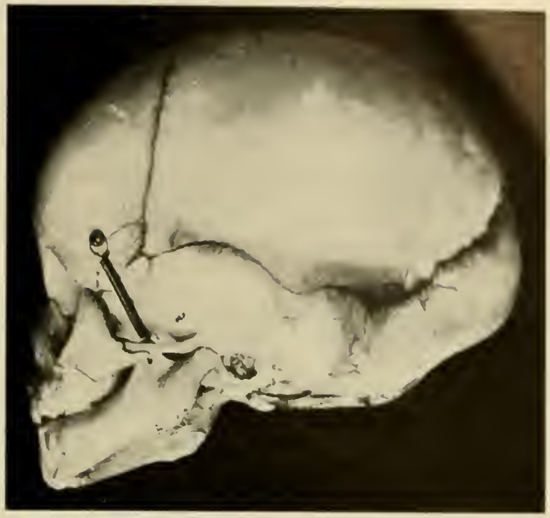

Fig. 25.

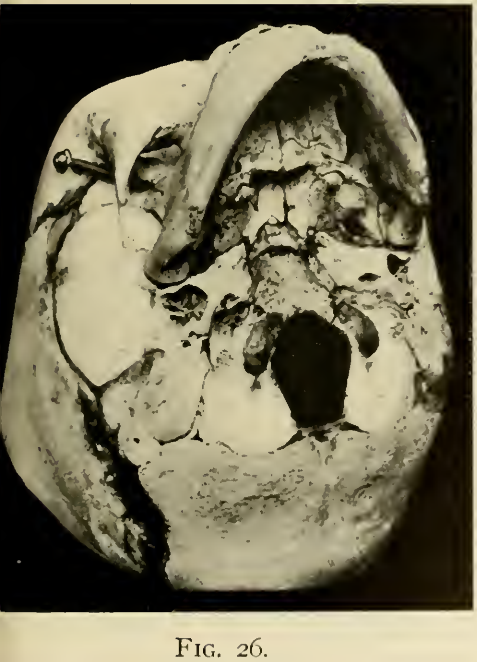

Fig. 26.

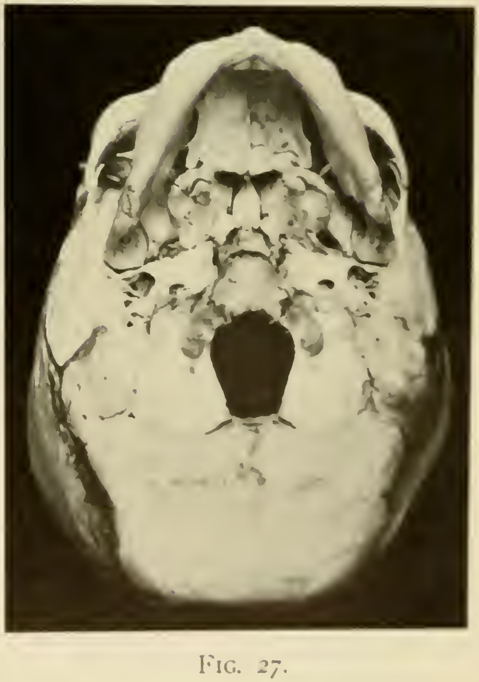

Fig. 27.

developing auditory process. The external tympanic membrane is removed and the ossicles of the ear are brought into view.

Fig. 27. Fig. 27 is made from the under surface of a skull in which the ear bones are plainly seen. The handle of the malleus, which originally was part of the same cartilage (Meckel's), from which the mandible was formed, is well shown. It also demonstrates the close relation to the developing external auditory plate and canal.

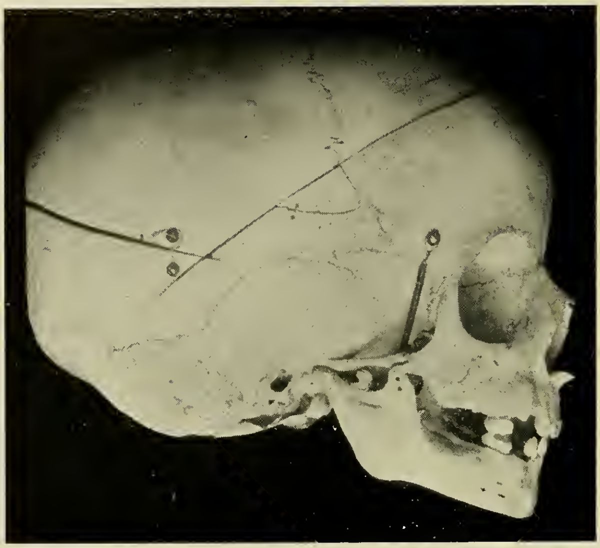

Fig. 28.

Fig. 28. Fig. 28 is made from a side view of a child's skull about eighteen months of age. The first deciduous molars are in position, but not in proper occlusion, as the mandible is carried slightly forward, which can be seen by examining the articulation. At this age the auditory process is fairly well formed.

Fig. 29. Fig. 29 is made from the same skull as Fig. 28, giving a view of the inferior surface. It shows the dehiscence, an opening in the tympanic plate, still patulous at this age, but which normally becomes filled in with bone as the tympanic plate develops. In some cases this dehiscence remains open through life, or the tympanic plate as a whole fails to be formed, making one cavity of the glenoid fossa and the external auditory canal.

Fig. 30. Fig. 30 is a side view of a skull that was used by Dr. Kirk in discussing a paper of Dr. Talbot in regards to "jumping the bite"; this was about fifteen years ago. The skull offers marked evidence that the man had brought about a "jumped bite" by carrying his jaw forward on the left side in order to bring into occlusion a few remaining teeth. The condyloid process is carried forward until it rests on the *eminentia articularis*. Both the condyloid process and the *eminentia* are flattened, the bones coming into undue contact, which caused a certain amount of resorption, and at the same time the inflammatory excitement of the osteoblasts caused bone to build around the edge, making the articulating surfaces broader than they would naturally be.

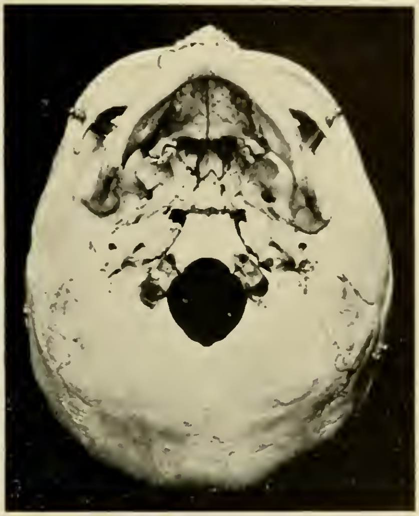

FIG. 29.

Fig. 31. Fig. 31 is made from the opposite side of the same skull, as Fig. 30. The articulation is more of a pivot joint, and has not had the ability to move on to the articulating eminence.

Fig. 32. Fig. 32 is a side view of a skull belonging to the Peabody Museum of Harvard University. I am indebted to Dr. Howe, of Boston, for three photographs of this skull. It exhibits a massive jaw with an acute angle, and at the same time forming a "forward bite," which, I think, is rather un-

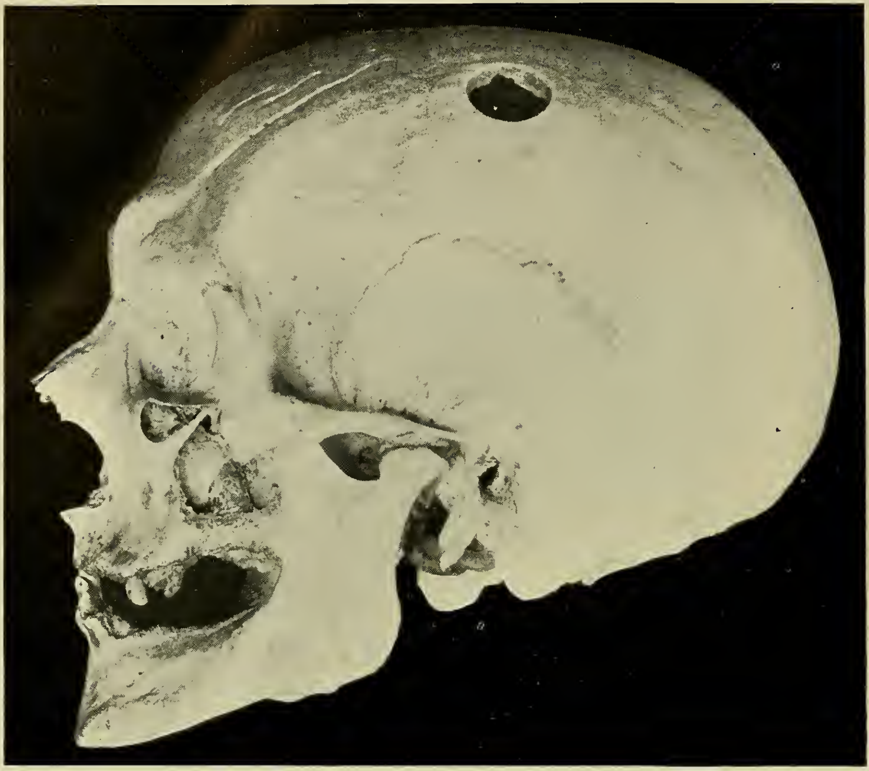

Fig. 30.

common; but when the articulation of the two sides of the skull (see Figs. 32 and 33) are examined it will be found that the condyloid processes are carried forward upon the articulating eminences, and at the same time it would appear that if the lower jaw were carried back by any mechanical means, resorption of the auditory process would take place.

Fig. 33. Fig. 33 is made from a side view of the same skull, as shown in Fig. 32. The general character is the same. The temporo-mandibular articulation is somewhat more deformed than that shown in Fig. 32.

Fig. 34. Fig. 34 is made from an upper view of the mandible of the same skull as shown in Figs. 32 and 33. It will be noticed that the condyloid processes, especially the right, are modified through the general pathological changes of the temporo-mandibular articulations.

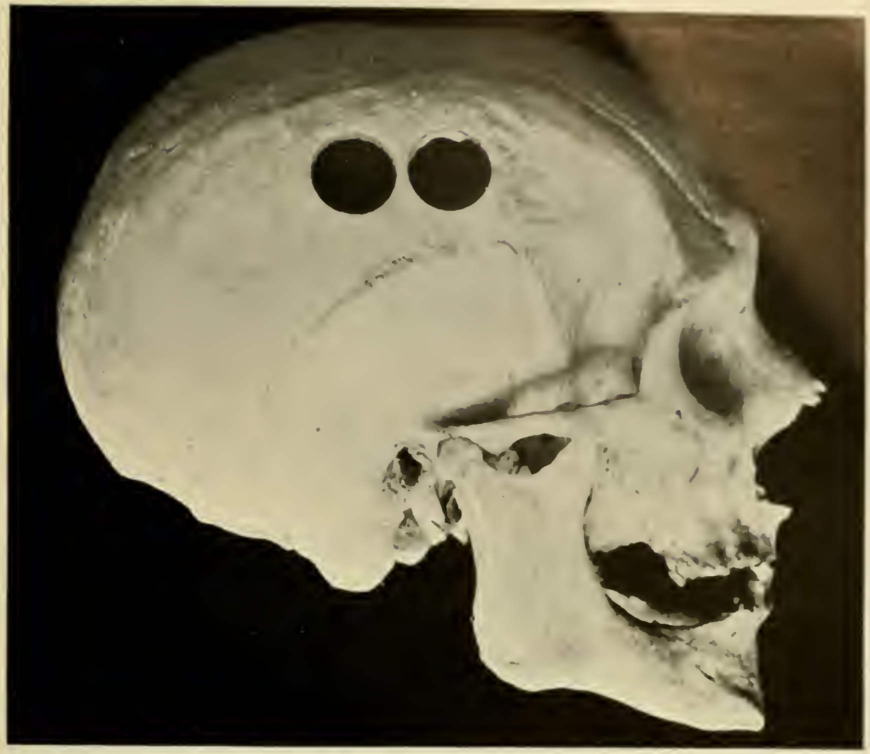

FIG. 31.

Fig. 35. Fig. 35 is made from a frozen sagittal section cut through the condyloid process and the glenoid fossa. The view is looking outward from the internal portion of the face. Just behind the condyloid process the soft tissue can be seen. There is also a pathological opening through the posterior wall of the fossa into the auditory canal and middle ear which extends backward into the mastoid cells, and there is also an opening externally through the mastoid process which is not shown in the picture. Pathological conditions extending from the mastoid process through the ear to the glenoid fossa are often found. Therefore, when the orthodontists do anything that may change the relation of the articulation, they should take into consideration the possible pathological changes that could be brought about.

Fig. 36. Fig. 36 is made from a side view of an aged skull where all the teeth have been lost, and where the chin is carried upward and forward in making

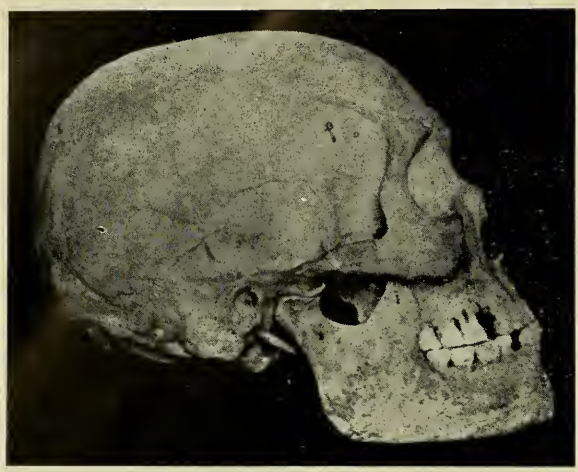

FIG. 32.

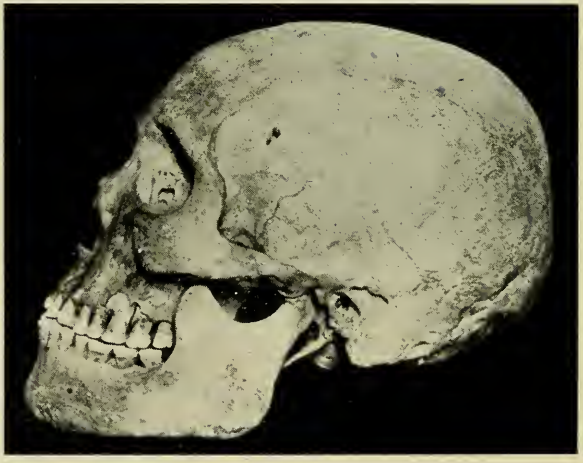

FIG. 33.

its circle, while endeavoring to have the lower jaw come in contact with the upper one; the muscular tissue, in cases of this kind, also endeavors to force the jaw backward, so much so, that the condyloid processes are forced against the posterior portion of the glenoid fossa, which often causes resorption of the bone allowing the condyloid processes to partially or wholly close the auditory canals, causing deafness. This is so common that the aurist when examining the ears of many aged persons is compelled to have the patient open the mouth widely; in so doing the external pterygoid muscle draws the head of the condyle forward, which allows the speculum to be pressed into the auditory canal.

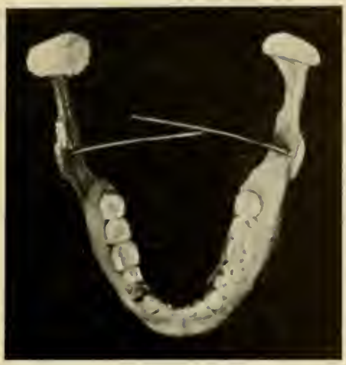

FIG. 34.

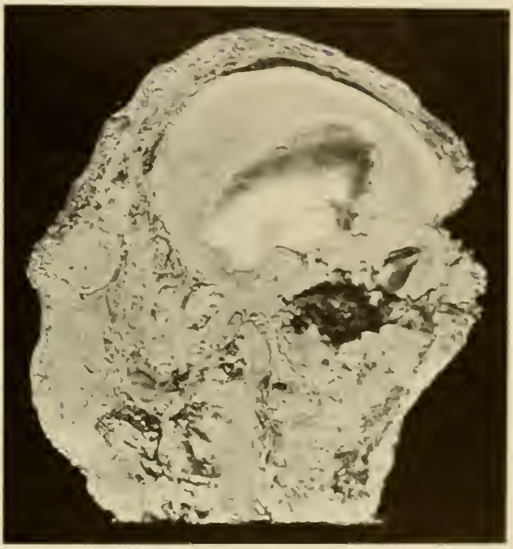

FIG. 35.

Fig. 37.

Fig. 37 is made from a side view of a skull which shows teeth in a forward occlusion of about one-half the width of a molar tooth. Compare it with Fig. 5. Although it has the forward bite, the condyloid process is placed well back in the glenoid fossa. It will be noticed that the auditory process has either never been formed or that it has been lost by resorption through some pathological condition. It is possible that this man wore some mechanical appliance for carrying the jaw back in order to overcome the malocclusion. In some cases I fully believe that "jumping a bite" backward the width of half a molar tooth could bring about such a result as is here shown.

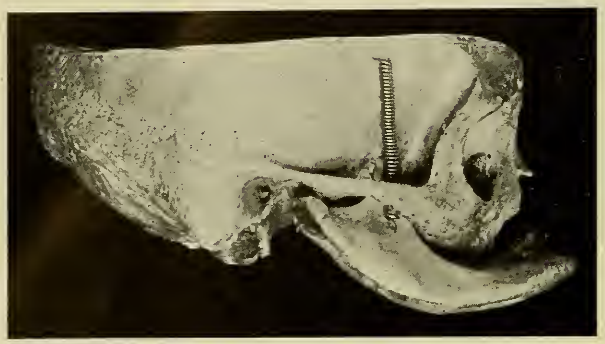

Fig. 36.

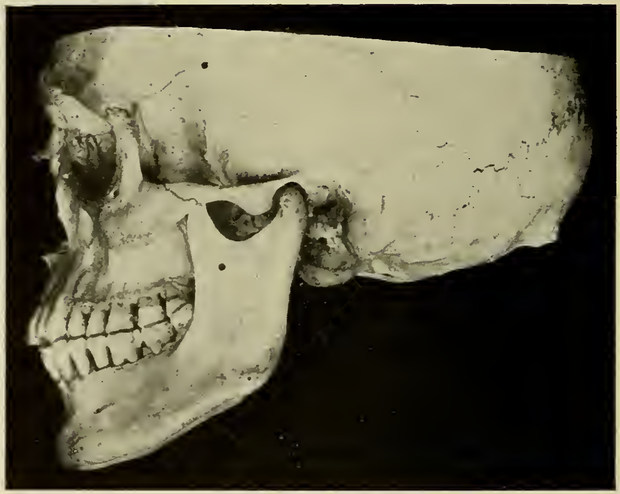

Fig. 37.

Fig. 38. Fig. 38 is made from a side view of a skull with a diseased external auditory canal; the greater portion of the division between the glenoid fossa, the middle ear, and the external auditory canal has been lost by disease. The positions of the teeth and other abnormal conditions indicate that there has been a general disturbance in this region from early life.

Fig. 39. Fig. 39 is made from a side view of the same skull, as shown in Fig. 38. Here again the auditory process has been lost, the condition of the canal indicating disease for some time before death. The teeth of this side of

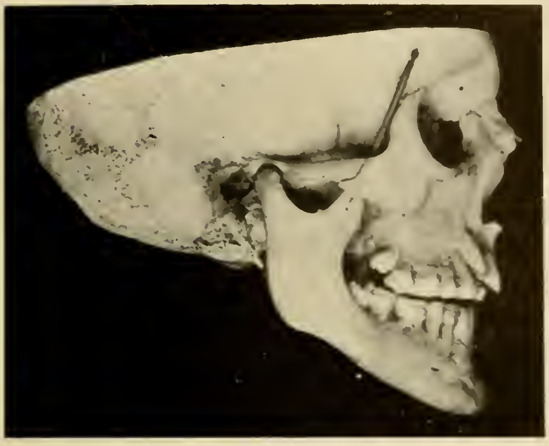

Fig. 39.

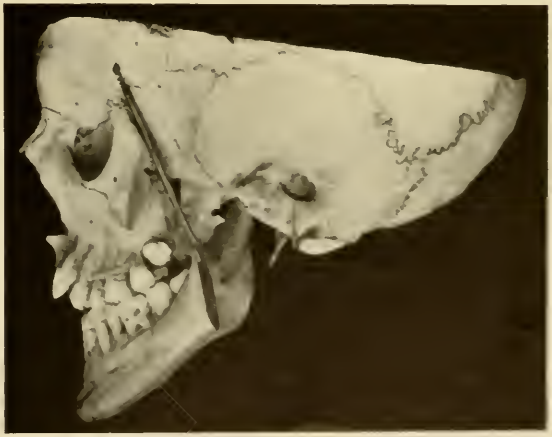

Fig. 38.

the skull are also in malposition. No one in such cases should undertake to make a general correction of the deformities in the positions of all these teeth, as I have seen general and serious ill health caused by a too sweeping correction of irregularities. This is one of many reasons why I feel most strongly that an orthodontist should, like the President of the United States, think before he acts.

Dr. Barnes. If I may have a slide (Fig. 8 of Dr. Weeks) I will call attention to one little fact. Dr. Weeks said, in referring to this skull, that it was of a child about five years of age, and that the relation of the teeth on the left side was normal, mesio-distally. The markings on the molar seem to indicate a distal articulation. It shows signs of being incorrect. At five years of age there should be growth spaces distal to centrals, laterals and cuspids in both upper and lower. We have a characteristic placing of these incisors and cuspids, such as we call a close bite in older cases. The significance of this seems to be that the portion of the mandible anterior to the mental foramen is very much under-developed. Another point, in this mandibular relation, is to find out whether we can shift the articulation. In some cases we seem to hold it after bringing the jaw forward. In other cases we get it forward and it slips backward again.

Dr. Cryer. I said in my little preamble that we should look around the circle before we judge. I do not always do it, and I fear that neither Dr. Weeks nor Dr. Barnes did it. This is an abnormal skull in almost every way. I should say the child died of rickets. You can not judge that skull for a normal or typical one.

Dr. Palmer. Dr. Cryer, how do you account for the distance there between the tympanic canal and the condyle of the jaw? (Fig. 10, Weeks.)

Dr. Cryer. I think there has been more bone deposited there than belonged there. I would like to look at this skull, and hope Dr. Weeks will let me do so.

Dr. Ottolengui. Does Dr. Cryer mean the whole cranial cavity is overgrown?

Dr. Cryer. Yes, it is all wrong. It is out of all proportion, and I think any of you who have studied skulls would acknowledge that it is an abnormal one, and you can not study normal points from an abnormal skull.

Dr. Weeks. There is very little to say in closing the discussion of this paper. I do not well enough understand the question raised by Dr. Barnes to enable me to satisfactorily reply to him. I do not believe Dr. Barnes has, as yet, sufficient data to prove that one portion of the mandible may be under-developed while another may be fully developed. If this were applied to the alveolar process, as determined by the position of the teeth, I would fully concur with him.

I do not believe you can explain the lack of prominence of the chin in all cases by saying that it is a lack of development of the mandible itself; if that were the case you would find that in cases of Class II there would be a general condition of impaction of the third molars. My observation and the observation of others does not lead me to believe this to be the rule. I have seen no more cases of impaction in Class II cases than in Classes I and III.

I do not wish to be understood to believe that in no case is there a lack of development of the mandible, but that in many cases the malocclusion may be due to abnormality of the temporo-mandibular articulation.

I can not see sufficient indication in the skull referred to to form the conclusion that it is generally in over-developed skull. Particularly, in closing, I wish to express my appreciation of the time and thought Dr. Cryer has been generous enough to give to the discussion of my paper. Also, to my indebtedness to him for the use, in illustration, of specimens from his valuable collection.

THE AMERICAN SOCIETY OF ORTHODONTISTS

NINTH ANNUAL MEETING, HELD
AT CLEVELAND, OHIO, OCTOBER 4th,
5th, 6th, NINETEEN HUNDRED NINE

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5th, 6th, NINETEEN HUNDRED NINE

Dates and Places of Meetings of The American Society of Orthodontists

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First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9, and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903, January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30 and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

Ninth Annual Meeting held at Cleveland, Ohio, October 4, 5 and 6, 1909.

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Table of Contents

President's Address
F. M. Casto, D.D.S. 5

Report of Work on "Base versus Noble Metals in the Mouth"
Clarence J. Grieves, D.D.S. .. 15

The Laws of Antagonization of the Teeth in Orthodontia
Leuman M. Waugh, D.D.S. 40

Malocclusion from the Dentist's Standpoint
Dr. E. E. Hall 72

The Field of Osteoplastic Operations for the Correction of Deformities of the Jaws
W. Wayne Babcock, M.D. 81

Clinics—A Retainer
Dr. Howard D. Keeler 113

Working Retainer; Skeleton Bite Plane; Elevating Bicuspids
J. Lowe Young, D.D.S. 115

Extension Tooth Movement, Split Tube Attachment, Lingual Attachment for Clamp Bands
C. A. Hawley, D.D.S. 117

Widening the Molar Region
R. Ottolengui, D.D.S. 119

The Northcroft Plaster Plane
Dr. Hedley C. Visick 122

The Square Buccal Tube
F. C. Kemple, D.D.S. 124

Parallel Anchorage Appliance
Dr. Varney E. Barnes 125

Method of Shifting Teeth Around an Arch
Dr. Varney E. Barnes 126

Surgical Treatment of Cleft Palate
Dr. C. T. Lyons 128

President's Address.

By F. M. Casto, D.D.S., Cleveland, O.

Let me assure you, my dear friends, it is with very great pleasure that I call to order the ninth annual meeting of the American Society of Orthodontists. The distinguished honor you have bestowed upon us by accepting an invitation to meet in our fair city is most highly appreciated. I trust this meeting will be as productive of good as have been our previous meetings. They have not only been productive of good from the standpoint of the scientific papers presented, but from the sociability of the members as well. For what gives one more pleasure and imbues one with more enthusiasm in his work than to grasp the loyal hands of his old American Society friends and discuss with them the successes and failures in their respective practices? I believe that things of practical benefit do now and will hereafter emanate from the men actively engaged in the practice of orthodontia, and who are capable of the successful application of new and practical theories. There certainly have been many theories advocated in the past that were of no practical benefit, and no doubt most of us have suffered more or less by attempting to follow them. I think, however, the time has come when we will not be so gullible.

In view of the fact that there seems to exist in the minds of many of the profession a misapprehension regarding the objects and practices of the American Society of Orthodontists, and the further fact that many

Reprint from Items of Interest.

of its members are not conversant with the early history of the society, I feel it opportune to give a brief account of the organization. Upon the first page of the secretary's book there is written the following:

History of the Organization of the Society.

"In November, 1899, Dr. Edward H. Angle discussed with Henry E. Lindas, Thomas B. Mercer, Herbert A. Pullen and Milton T. Watson, who were in St. Louis taking lectures under him, the need for a society whose chief aim should be the advancement of orthodontia. The subject was earnestly discussed, but the time seemed not yet ripe to organize.

"The following spring, or in June, 1900, while celebrating the close of the first session of the Angle School of Orthodontia, with a banquet tendered its teachers by the students, the subject of a society of orthodontists was again discussed, and Dr. Richard Summa moved the formation of a temporary organization. Edward H. Angle was elected president and Milton T. Watson, secretary. The president appointed F. W. Rafter, Thomas B. Mercer and F. C. Kemple a committee to adopt a constitution and by-laws. By unanimous consent it was arranged to hold the first annual meeting in St. Louis, Mo., in June, 1901. The result of these efforts is already a matter of record."

The first meeting was held in St. Louis, June 11, 12 and 13, 1901. Those present were Drs. E. H. Angle, Richard Summa, M. T. Watson, W. J. Brady, E. E. Walker, H. E. Lindas, Grafton Munroe and L. S. Lourie. Resolutions and by-laws were presented and adopted. The following officers were elected: E. H. Angle, president; W. J. Brady, vice-president; M. T. Watson, secretary and treasurer; Richard Summa, H. E. Lindas and W. E. Walker, Board of Censors. Several papers of importance were presented. This meeting then was the formal launching of the good old ship, the American Society of Orthodontists, a society that has been making history and doing a remarkable work, and which is destined to be responsible for a very large proportion of the future scientific developments in orthodontia.

The following year the meeting was held in Philadelphia, October 8, 9 and 10. The good work continued. Some very valuable contributions were given. Several new members were admitted. The enthusiasm displayed at this meeting proved beyond a doubt that the American Society had come to stay. The other meetings have been held in Buffalo, St. Louis, Chicago, New York, Detroit and Washington, respectively.

The custom of holding the meetings in a different city each year has been a most beneficial one. It has given the members an opportunity to visit the various large cities, besides enabling the Board of Censors to secure material for the program, which would, otherwise, have been difficult or impossible to get. It has also afforded an opportunity for the general practitioners and other persons interested in orthodontia in the various sections of the country to attend the meetings. I hope this custom will continue until all the large cities shall have been visited.

The society has steadily grown in power and membership until now it has one or more representatives in practically every large Ameircan city and in some European cities. The active membership consists of men exclusively engaged in the practice of orthodontia and teachers of orthodontia in recognized dental schools. Any person or persons are eligible to membership who comply with those conditions and who are willing to conform to and abide by the constitution and by-laws. However, quality rather than quantity has been considered in enrolling members. I desire to state further that the society has always extended to those interested in orthodontia a cordial invitation to attend any or all of its sessions, and have always encouraged free thought and speech. Article 11 of the constitution reads: "The object of this society shall be the advancement of orthodontia and the establishment of the science as a distinct dental specialty." I am certain that the members have complied with this section in the broadest sense and have without the slightest hesitancy always encouraged the unfolding of knowledge in orthodontia to all persons interested.

One of the most delightful things about the society is the friendly feelings existing between its members, and their willingness to impart knowledge to each other and to the profession in general. Nothing has been of more practical benefit to myself than the privilege of visiting other men's offices and learning how they do things. I am sure this condition of affairs should always exist and the members, individually and collectively, will be held responsible to see that it does. The closer the relationship between its members the more powerful will be the society, and the stronger the society the greater the good that can be done.

Progress Past and Future.

We must all agree that the progress in orthodontia has been marvelous in the last decade of years; order has been brought out of chaos and the successful practice of orthodontia has been established. Yet it is reasonable to suppose that just as much or more advancement will take place in the next decade. There is at present more original research work being done, and the practical application of methods is immeasurably greater. A great many theories have been found useless and have been abandoned. Many things that floated in on the tidal wave have exploded and sunk. Men have come to realize that it is not possible to dogmatically practice orthodontia according to any particular rule or method, the requirements in many cases being so varied that constant study and thought are necessary. The field for study has increased so rapidly that there has not been sufficient time nor opportunity for complete development in any one particular branch. I fear that in our great anxiety to develop something new, many of the old and more important things have been neglected. We could profitably devote the time of an entire session at one of our meetings to the study of retention. This is undoubtedly one of the most important subjects in orthodontia. We stand or fall upon our ability to retain the teeth in their corrected position. Considerable time must yet be spent in the study of diagnosis, early treatment and a number of other subjects equally as important.

Influence upon the Nervous System.

The question has been raised by some medical men regarding the effect that an orthodontic operation might have upon the nervous system of a patient. I have heard of a few cases where it was thought that the operation produced more or less severe nervous troubles. There was not sufficient evidence produced, however, to hold the orthodontic treatment entirely responsible. I do not believe that an operation carefully and properly performed will produce any nervous disturbance; the work is always under control and may be discontinued at once should there be any reason to do so. On the contrary, I believe that the correction of irregular and crowded teeth will relieve many cases of nerve strain. The investigations of Dr. Upson, of Cleveland, to my mind, confirm that belief. He claims that a lesion may exist which will be sufficient to cause insanity by cell degeneration in the brain without any evidence of pain on the part of the individual affected. Dr. Upson has proved that some forms of insanity are caused by dental lesions, such as impacted and pulpless abscessed teeth.

If it be true that insanity is sometimes caused by the impaction of one or two third molars, why would not a greater nerve strain be produced where all the teeth are irregular and crowded into narrow contracted arches? The establishment of normal occlusion should prevent the impaction of teeth. Some specific investigation of this subject would undoubtedly be of considerable interest and benefit and should be made. It will be necessary for the orthodontists to correct any wrong impressions that may exist in the minds of the medical profession regarding the orthodontic operations.

The Problem of Fees.

Another question that should concern the orthodontists is the fee to be charged the patients. In the search for scientific knowledge the business side of our work must not be overlooked entirely. A custom established for many years, and followed by a number of orthodontists, has been to name a definite fee at the outset for the complete operation. I am not sure that this method will in the future always be conducive of the best efforts on the part of the orthodontist and prove most satisfactory to the patient. We all appreciate that it is very difficult to determine the exact extent of services to be rendered in a given case of malocclusion. I believe suggestions upon the questions of fees would be gladly received by the members of this society.

Education of the General Practitioner.

There is one other thing which seems to me to be of importance, and that is the establishment of a definite method for educating the profession in orthodontia, and educating the laity in the care of children. Certainly the profession has access to all the dental literature, the privilege of attending the orthodontia meetings and to come in almost daily contact with the orthodontists. There is little provision whereby the laity may become acquainted with the needs of their children.

In talking with a prominent surgeon of this city some time ago he informed me that at one of the surgical meetings a number of the men formulated a plan whereby an article of interest and benefit to the public would be published at various times upon various subjects; they were of the opinion that considerable good to the people would result from such a plan. I do not know whether any such thing would be feasible or not, nor have I any plan to suggest, but it is certain that if the mothers knew what and how to feed their children, how to give their teeth and mouth the proper attention, and the necessity of doing these things, a great many malocclusions would be prevented, and we all agree that the highest aim in orthodontia is the prevention of irregularities of the teeth.

In conclusion, I wish to call your attention to the fact that the achievement in other professions have kept pace with the wonderful advancement in orthodontia. In medicine, the serum-therapy treatment and the vaccine treatment are being thoroughly exploited. In surgery, the transfusion of blood and the probable cure for cancer are distinct advancements. The casting of gold for various uses marks an important epoch in dentistry, and the "solgram," or sun process for producing a photograph in nature's own colors, promises much in photography. The four-day boat acros the Atlantic has become a reality. Wireless telegraphy and telephony have been made practical. New records in almost every line of human endeavor have been made. The sun's rays have almost been bridled, and last, but not least, the North Pole has been discovered.

The society is to be congratulated upon having such an excellent program as arranged by the Board of Censors. I wish to thank them personally for their splendid work. I desire also to thank the members of the society again for coming to Cleveland this year. I hope that you will all go home wiser and better men for the coming.

Discussion of President's Address.

Dr. Ottolengui.

I wish to allude to two or three points introduced by Dr. Casto. First, as to the subject of retention. I think that when we make a contract to correct a case of malocclusion, the patient has a legal and moral right to expect that we will retain whatever we obtain in the way of improvement. Many of us receive our fees when we put on the retainers; a few do not, and, it seems to me, if we do, we are likely to lose a financial if not a professional interest the case, because all fees have been paid; and yet, of what advantage is the work to the patient if a retrogression occurs subsequently? We are not giving as much attention to the matter of retention as we should. If we go back to not so very many years ago, the correction of malocclusion was in a very chaotic stage, considered from the standpoint of the diversity of appliances. Do we not have as much individuality exercised in retention? The president is quite right in suggesting that a great deal more study and attention should be given to this problem. If some of the men have solved it, it should be their duty to the society to come and explain these facts to us. I should like to see two whole sessions devoted to the retention of Class Two and to Class Three cases at our next meeting. I think the Class One cases have been fairly well worked out, except infra-occlusion, and that occurs in all three classes.

The Aims of Orthodontia.

In regard to the question of the influence of these operations on the nervous system of the child, and the statement made by the president that the highest aim of orthodontia should be to prevent malocclusion, I agree that it is a high aim, but do not think it is the highest aim. Formerly, the correction of irregularities was more especially a cosmetic operation; it was born of the desire to make the child pretty. We give too much thought to the restoration of the teeth to the proper arch alignment. I think it is quite as important to restore a normal occlusal plane as to restore a normal arch alignment. I am beginning to be a believer in the beneficent influence of proper mastication, as announced by Mr. Fletcher. If you masticate your food thoroughly you will need less of it to maintain the vital energies of the body, and thus prolong life and enable the individual to more readily throw off the attacks of the various so-called germ diseases. The child's malocclusion should be corrected, not to make it pretty, but so that it will not need an appendicitis operation:

so that it will be more immune to various diseases. A normally vital human being is immune to the majority of diseases.

How can one properly masticate food if he has not a proper masticating apparatus? The arrangement of the occlusal plane is more important than the alignment of one or two of the front teeth. The incisors are for incising food, and one may cut bread with incisors rotated as well as with them straight, but with narrow arches one can not possibly masticate food properly.

I look forward with interest to the paper announced on the program by Dr. Waugh. In addition to the help we have had from Dr. Hawley in establishing the curve of the arch, we should have an anatomical articulator, to which we can attach our casts and study the various excursions of the mandible and see to what extent the vertical development of the teeth are at fault. Establish normal occlusal planes first, and, secondly, normal arch alignments, to contribute to the health and beauty of the child. If thoroughly scientific and capable, we could render every child healthy by our services.

Dr. Ketcham. I was much impressed with the president's address, and the discussion by Dr. Ottolengui. I am very glad, indeed, Dr. Ottolengui spoke of Mr. Horace Fletcher's teachings, and that he referred in that connection to the advantage of an ideal relation of the occlusal planes of the teeth. For years I have fought against an impaired physical condition, and have tried Fletcherizing in a rather indifferent way. However, I find it to be a great thing, and believe that in making it possible for our patients to attain the greatest efficiency in the use of their teeth we are rendering the highest service. It naturally follows that if the inclined planes of the teeth are in ideal occlusal relations we will have the curve of the arch in ideal relation to the face and will have an ideal development of the face and the greatest degree of nasal development, and that we will do that child the greatest amount of good that is possible. The question of retaining this ideal condition after it is once acquired, troubles us more than anything else. It is only by working together that we can solve this problem.

Dr. Pullen. I have not in mind the principal points of the paper, but its general tone was certainly in the line of progress, and speaking along the line of the previous gentlemen I will say that the Board of Censors selected Dr. Waugh to give us his paper on the laws of articulation for the reason that we wanted to make a special study of the occlusion and antagonizing planes. You will find they have much to do with the physical and pathological development of the child.

Dr. B. E. Lischer. One topic in the president's address that appealed to me, and which has not been discussed, is his reference to fees for services rendered. Having been a close student of the work of this body ever since its organization, I recall that you have taken action on that phase of the fee question relating to the paying of commissions, which action I heartily indorse. It has always seemed to me that the practice of charging a fixed fee, of contracting our services in advance of treatment, militates aaginst the best results in orthodontia.

In the "Golden Rules of Surgery," by the late Dr. Bernays, we read: "Surgical services have no fixed value; they are invaluable." May not the same be said of orthodontic services? And while surgical operations frequently involve the life of the patient and are of very short duration, the major part of the necessary after treatment is usually intrusted to a nurse or assistant. This has led surgeons to favor a definite financial agreement with the patient, in advance of the operation. Our treatment, on the other hand, extends over a long period of time, in which respect it is more like medical practice. Moreover, fully 90 per cent. of our services are rendered for the correction of anomalies of position of the teeth, only occasionally for anomalies of form, of number, etc. Now the essentials of a differential diagnosis of the anomalies of position are simply stated as follows: Malocclusion of the teeth, malrelation of the dental arches, and malformation of the jaws. In many of our cases we find a combination of these three conditions, and we are proud to define orthodontia so broadly as to include prevention as well as cure.

The continued growth of the appreciation of orthodontia is materially affecting our practice, and parents are aware of the value of early treatment. At this moment I have in mind a patient eight and one-half years old, with the most pronounced type of distal occlusion I have ever dealt with. The bilateral distal malrelation of the lower, as a result of arrested development of the mandible, is very evident, though I have succeeded in establishing a normal occlusion of all of the permanent teeth thus far erupted (twelve in all) in the short period of four months. But my services do not end with the application of the retention appliance, nor with its probable removal a year or so hence. On the contrary, the one and only agreement that I have with his parents is, that I am to have the child in my care until the cuspids, bicuspids and second molars have erupted, when he will have reached his thirteenth year. Approximately five years of service; then how unreasonable the demand for a fixed fee in advance!

The point I wish thus to emphasize is, how can any one tell in advance the services even this one case will require, until it may be dismissed as cured, as permanently normal? I know very well the arguments in favor of a fixed fee plan, but again I say it is to the interests of all concerned never to adopt it, for it involves the distinction between jobbers of orthodontia and practitioners of a remedial art. I can conceive of an ideal state of society, in which parents would freely pay liberal fees for services such as we daily strive to render, but in the utilitarian age in which we live, in which good health and physical efficiency are grossly underestimated and but faintly comprehended, men are not so willing. Some form of system we are thus forced to adopt. Aside from the patient's ability to pay, the proper basis for every fee is the prompt (preferably monthly) settlement of all obligations for services rendered, and no more. And since there are no two cases exactly alike, there can be no two fees alike.

Finally, mention may be made of the child returning from a vacation, or from a prolonged illness, etc., during which time a retainer, or an appliance for treatment, might quite naturally become ineffective. And suppose that prior to such an unfortunate, though not frequent, incident the last installment of a fixed fee has been paid. Ought the extra services thus made necessary be rendered gratis? And is it not true that the fixed fee arrangement frequently leads to that most unjust demand of all medical service—the guarantee—the unprofessional nature of which I need not dwell upon?

Mr. Hedley C. Visick, London. In Germany they charge by the time taken for the operation. As Dr. Lischer says, one never knows what time will be needed on a case. The patient may become ill, and the work you have already done may be undone, wholly or in part. In England, the majority charge so much per hour for the work. I have occasionally charged a stated fee for a case, but it seems an unsatisfactory arrangement. I can quite recommend the time fee to you, but, of course, there is much difference in the speed with which a man works. One man will do four times a given amount of work in a stated time as another. The amount charged for an hour's work should differ with different men.

Dr. Burrill. With reference to the point in the president's address relating to the fact that we are sometimes accused of causing nervous disorders. Are such disorders supposed to relate to the sensory and sympathetic, or to the motor nerves? I have been accused recently of causing paralysis. I would like a little light an this subject.

Dr. Federspiel. I had the opportunity for about three years to do a certain amount of orthodontia for which I received no fees and for the purpose of gaining knowledge. I came in contact with some people who were very poor. In some cases the head of the family was earning probably nine or ten dollars per week.

I believe, however, that orthodontia is priceless. You have a right to charge a large fee and still you must be charitable. A surgeon informed me that he had a practice of $25,000 per year and received only $5000 in fees; the remaining $20,000 was charity. If I charge $5000 and the patient can afford to pay it, it is reasonable. If I treat the child of a poor scrubwoman, my services may be donated. The proportion of charity and charges must be based on the financial condition of the patient, or, rather, of the parents.

Dr. Bethel. As you have called upon me, I will say that I was much pleased with the address of the president, and concur in what has been said. I feel that we could very profitably discuss some of these questions separately and at a special time during one of our future meetings, and hope they will be placed on the program as special papers or for discussion. Certainly the points brought out in the paper are valuable to us, and some have not been worked out as thoroughly as they should be, so I hope we may take them up individually and work them out more at length than we would be able to do in this discussion.

President Casto. Regarding the question of Dr. Burrill, of Chicago, with reference to alleged effects of orthodontic operations on the nervous system, I do not know what the specific claims are of those physicians who make complaints. A good many physicians, naturally, will blame orthodontic operations when they have nothing else to lay the trouble to, and it may afford an easy method of making a diagnosis. I think that subject should be given some specific consideration by this society, because such claims will militate against the work which is being done. Probably if all physicians were informed or educated in what orthodontia means to children, they would not be so likely to advise against it, or to attribute troubles arising during the operations to the operation itself, as they are liable to do now. It is a bit like the tendency a few years ago to attribute so many things to heredity.

Report of Work on "Base versus Noble Metals in the Mouth."

By Clarence J. Grieves, D.D.S., Baltimore, Md.

In following up the work assigned to this committee at the last meeting of the society, *i. e.,* the behavior of the different metals in the child mouth, and the damage resulting therefrom, your committee has to report a few variations as to minor details in saliva tests, which may vary for years to come, so complex is the subject. In the main, the cardinal points presented last year are confirmed by the year's work, and stand until furthermore questioned; for, like all such work, they are always subject to change.

Metals Used in Appliances.

We take this opportunity to accent the folly of using any alloy in the mouth which contains electrically opposed metals: German silver, plain or gold plated (Fig. 1); from 20-karat platinous gold, containing 2 per cent. zinc, all down the line of possible combinations containing base and noble metals in contact (Fig. 2).

Silver Ligatures.

Pure silver wire has been advocated for ligatures, because of a supposed tolerance of the tissues for silver. Physically it meets the requirements: under the gingival margin it maintains its color, as do other metals protected by the gingivus, without disintegration: above the margin, and exposed to saliva, it blackens quickly. The salts deposited are presumably sulphids, and if so quite bactericidally inert. The usual action of epithelial tissue on silver all over the body is the production of H_2S and sulphids. Silver foil applied directly to the freshly cut tissues precipitates silver salts when attacked by the tissue exudate, effectually preventing infection even on large surfaces. This, with sterile gauze and hot water, is the only method of sterilization employed for the most sweeping operations by one of the leading gynecologists of this country.

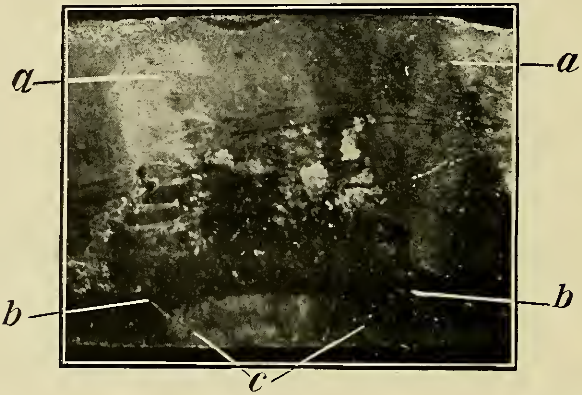

Fig. 1.

Fig. 1—Approximal portion of gold-plated German-silver molar anchorage band exposed three weeks in mouth showing damage at the gingival line. (*a*) gold-plating above the line; (*b*) line of crater at the line. (*c*) perfect gold-plating below the line

If saliva were as simple in its chemistry as the blood, the case would be parallel, but it is not. Michaels says, "The saliva contains every soluble and crystalline principle which is found in *excess* of blood plasma, and which is susceptible of being dialized through glandular activity." (*Sialo Semiology,* Michaels, Proceedings Third International Dental Congress.) So we can not presume that the salts would be the same, although this is not saying that silver is not fit in the mouth. Silver in contact with gold should not degenerate electrolitically, and it may be just the thing for ligatures.

We know of no substance which will take the place of clean metals in ligatures, and the question is far from being settled.

Conditions would be ideal, were it possible to do away with ligatures and with fixed appliances, and in the judgment of the writer it should be the aim of the orthodontist, first and foremost, after planning his appliances to produce definite results, to simplify the appliance into the easily removable class, and ligate as little as possible. The reasons are obvious and are given in my previous paper.

Mechanical Standards for Appliances.

While slightly away from the province of this report, the writer thinks he will be pardoned for the suggestion to follow, as it is of the highest import. The American Society of Orthodontists should establish a series of standards to be known as the "A. S. O." standards, not only in the metals to be used in appliances, their chemical and physical characteristics, but mechanically as to the pitch and size of the threads in bars, bolts and nuts, gauges of wire for accomplishing the greatest work with the least metal in arch retainers and ligatures; gauges of bands to meet stress; ductility, elasticity and tensile strength of metals, etc., etc. All such standards, when worked out by a committee of mechanical experts should be the property of the Society and should be known as "American Society of Orthodontists Standard." The manufacturers would then come to your society for his ideals instead of your going to him individually, and after untold trouble convincing him of the market for the particular appliance you wish made sufficient to warrant his making it. Orders from all over the country for "A. S. O." standards would produce the desired result.

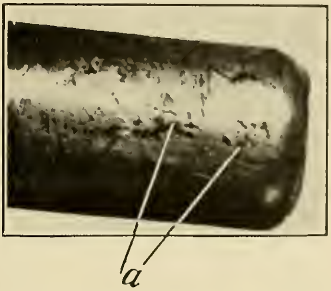

FIG. 2.

Fig. 2—Section of buccal tube worn two months: 18k platinum gold, 5 per cent. zinc. (*a*) craters by electrolysis.

For a parallel confirmatory case we have only to go to the great railroad world, where twenty years ago prior to the formation of the "Committe on Standards" of the Master Car Builders' Association, in the matter of car construction, chaos reigned supreme. Rarely could a freight car leave its home road without reshipping its load: parts of interchange differed with each road, and on a break-down the car had to be patched up and returned to the home road; there were as many forms, for instance, in car-couplers as there were "cranks" to patent, and manufacturers to produce them.

This situation was attacked by the "Committee on Standards" of the Master Car Builders' Association, made up of representatives from all the railroads in the country with a vote for every one thousand cars, and to-day all interchangeable parts, no matter where manufactured, must conform to "M. C. B. Standard," otherwise the railroads will not buy the product. A freight car may leave its home road and spend its life on foreign roads being repaired, never losing a load, and never returning; the salvage in time, trouble and money to the railroads and shipping, all the result of the work of this Committee, is simply incalculable.

Your society can accomplish in appliances like results, and it is a duty you owe not only to your membership, but to that vast majority of dentists compelled to do this work in communities which do not support an orthodontist.

Attaching Media for Appliances.

After a long series of observations on bands and retainers, we are more firmly convinced than ever before of the correctness of the statement that all bands, anchorages, retainers, etc., and all parts producing retention centers, should be covered by bands when necessary, to fix the appliance and be attached by some cementing media. The difficulty in obtaining attachment with oxyphosphate in orthodontia cases, the greater difficulty and pain in breaking such attachments when teeth are loose, the danger to the enamel of an unknown wash-out of cement under a band makes some other cementing media more desirable.

Doctors Young and Ottolengui have submitted specimens of retainers set with a gutta-percha preparation which, with others the writer has seen in and removed from the mouth, apparently prove this media to be most excellent.

Where the band remained attached in those examined, the adjacent enamel was in perfect condition, gutta-percha behaving, as it does in fillings, becoming leathery on the edges and swelling up, but preventing decalcification; it is only fair to state that these bands were of the bolt type, such as can be tightened up from time to time as the preparation swells; this is a great advantage in prevention of retention centers, and no advantage with oxyphosphate which such pressure will spoil and detach.

The palatal surface of a molar on which a band attached with cement had been loose for some time (Dr. Ottolengui's specimen) is submitted. This was cleansed, dried and exposed to nitrate of silver solution, and shows comparatively little decalcification (Fig. 3).

With the idea of combining gutta-percha and cement as is practiced in the setting of crowns, the writer has now three bands set in carious mouths with the gutta-percha preparations applied to tooth and the oxyphosphate to the bands; there is an appreciable element of safety in gutta-percha over cement, in that it is not subject to solution, and it would appear that the advantages of both would accrue if combined, but the writer's knowledge is not sufficient to recommend this method.

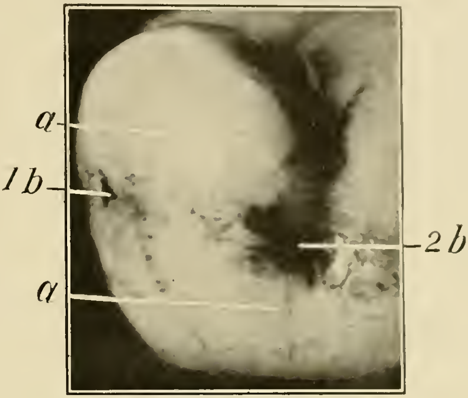

Fig. 3.

Fig. 3—Mesio-palatal angle of temporary molar (Dr. Ottolengui's specimen). (*a*) Parts covered by the band. (*1b*) and *2b*) Decalcification spots. It cannot be asserted that they had not occurred previous to placing of band; it is unlikely that (*1b*) had occurred.

Guarding Retention Centers.

Dr. Hawley suggests that after the case be cleaned up it be reset and then dried out as well as possible, and all retention centers between teeth arches and ligatures be filled with the ordinary sticky wax of the laboratory usually rich in gum copal.

The writer believes there is value in this idea and further suggests that the arches and ligatures be dipped for a slight film before being applied, or coated with cavity varnish that will protect from moisture and allow the wax to stock.

The Salivas of Children Wearing German Silver Appliances and the Metallic Waste Found Therein.

Careful chemical and microscopic studies were made of four samples of saliva of children wearing German-silver (plain and gold-plated) appliances and brass wire ligatures.

Only small quantities daily (before cleaning the teeth) of the night and morning saliva were collected covering periods of from six to nine weeks in total quantity of from about 75 c.c. to 130 c.c.

The report herewith of E. A. Slagle, Ph.D., Chief of Department of Pharmacology and Chemistry to the Johns Hopkins Hospital and Medical School, on the sample Dr. F. C. Kemple, is typical. Quantity of sample, 130 c.c.: 100 c.c. examined; girl patient, age 13 years; saliva taken over period of 9 weeks, morning before cleaning teeth and evening before cleaning teeth; patient wearing regular gold-plated German-silver appliances and brass wire ligatures: odor slightly fetid; reaction alkaline. Digested the sample 100 c.c. with 5 c.c. of sulphuric acid in a Kjeldahl flask without other oxidizer 9 hours, and then drove off the excess sulphuric acid; the digestion was carried out in a Kjeldahl flask on account of the volatility of chlorides of copper."

"To the solution acidified with hydrochloric acid was added potassium ferrocyanid, and only zinc ferrocyanid was precipitated."

"From another portion of sample zinc sulphid was precipitated. Neither ammonia, potassium iodid nor potassium chromate gave evidence of copper; the last-named test is sensitive to copper to one part in forty thousand."

"All tests for copper, nickel and iron were negative and the presence of a salt of zinc was confirmed to the amount of 5 Mg. (1-12 of a grain). From the position of the metals copper and zinc in the tension series (series of electro positive and negative substances; the amount of potential), one would not expect to find that copper had been dissolved from this alloy (German silver), and it can be easily calculated that the amounts of nickel and iron would be too small for detection in the sample."

The question of what salt of zinc was present was taken up and a reply had as follows:

"Since saliva contains normally Cl and SO_4 ions, it would only be a guess as to how the 5 milligrams of zinc were contained in the sample of 100 c.c.

"However, on filtering the saliva and washing with hot water, the filtrate gave no tests for metallic ions; this seems to indicate that the zinc was in combination as an organic salt with some of the constituents of the saliva. There is, of course, the possibility that the zinc was held mechanically even in an inorganic molecule."

Five Mg., or 1-12 gr. of zinc salt in 100 c.c. of nine-weeks' saliva, is a very heavy percentage when we consider that out of the full amount of German silver in a "tie-up" (84.6 grs.), two-ninths (or 18.6 grs.) is zinc; ten brass ligatures weigh 6.16 grs.; one-third of which, or 2.05 grs., is zinc, making the total zinc in "tie-up" 20 grs., and 1-12 grs. of this is found in a small amount of saliva taken in nine weeks. This is the normal percentage of waste metals from electrolysis out of an alloy like German silver (Cu. 6, Zn. 2 Ni), with the saliva as a mild electrolyte. Further, it is a positive proof that the alloy degenerates in the mouth by this method. Carrying this 1/12 gr. soluble salt to the ultimate, we are confronted by a paradox: the average day's saliva is 1000 c.c. (1 quart), which worked out in the ratio found in the specimen for nine weeks in 100 c.c. would show a total loss of 52 grs., and as a whole "tie-up" weighs but 90 grs., the waste metal would be more than half, an utterly impossible conclusion, and as we know the total loss roughly by weighing old appliances to be about 10 grs. in this period, it is demonstrated that metallic disintegration in the mouth is neither progressive nor regular and not a matter of arithmetic.

What Preserves the Saliva.

There are several very interesting questions growing out of these analyses of saliva.

It has been noted by Ferris (*Dental Cosmos*, Sept., 1909) and others, including the writer, that while normal child saliva kept for a short time is subject to putrefaction and most offensive, samples of saliva from the mouths of children wearing German-silver appliances may be kept for an indefinite period with practically no odor.

The samples analyzed were kept from two to three months in glass-stoppered jars and were but "slightly fetid." It is recognized that there are normal salivas, specimens of which can be kept some time without putrefaction, but in the writer's experience these are invariably the salivas of adults. Child saliva invariably decomposes offensively.

Michaels says, "The salivas of adolescence contain a dextrine principle (glycogen) susceptible of fermentation under the influence of ptyalin in the presence of earthy salts" (*Ibid.*). Add to this the presence of decomposing food from retention centers about appliances and we have what should be one of the most offensive specimens of saliva imaginable, instead of one "only slightly fetid," and it becomes a question as to what the preserving element is.

It will be recalled from my last paper that the analyses of the dark salts found on the teeth and appliances proved to be insoluble sulphids of copper and possibly nickel. That a white salt (again insoluble) was found on appliances giving a reaction for copper and phosphorus, presumably a phosphate; while this salt was totally unlike salivary calculus, amorphous compared to the crystalline calculus and was rare, existing in small quantities, the very difficulty of collecting might have introduced particles of calculus spoiling the analysis.

These are the only insoluble salts of metals found after the most careful work of last year by Schmidt; the only soluble salt is that reported herewith shown by Slagle to be presumably an organic combination of zinc; copper is not present in more than 1 to 40,000 by the chromate test; the only germicidal salt of zinc is the chlorid, and the question would be easily settled if chlorid of zinc were present, for chlorids are readily detected, but by every reagent in this analysis chlorids are excluded.

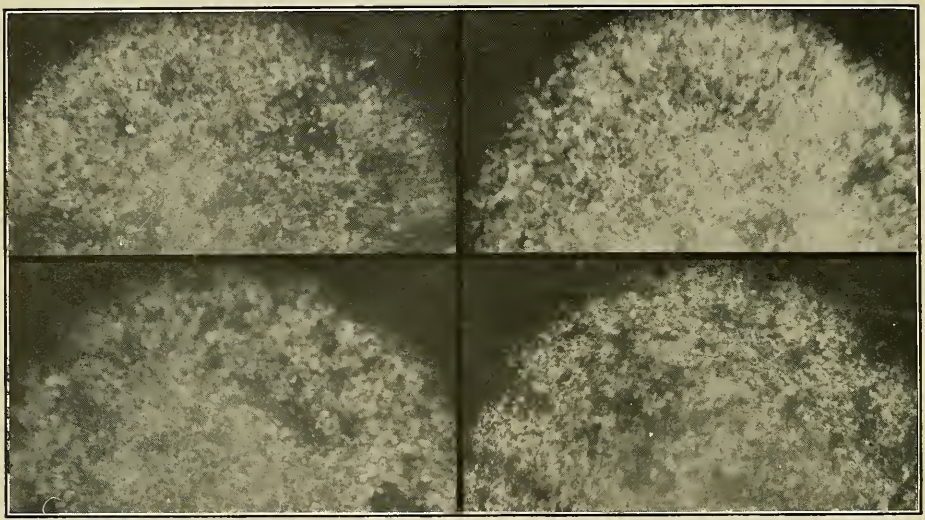

FIG. 4.

Fig. 4—Slides from nine weeks, morning and night saliva of children wearing gold-plated German-silver appliances. A and B from the heavy precipitate at the bottom of the jar. C and D after shaking thoroughly.

In discussing the writer's paper, "The Behavior of Certain Metals in the Mouth" (*Dental Cosmos,* Sept., 1909), Ferris says that crystals of the sulphate of copper have been detected by Dr. Dexter microscopically in the salivas of children wearing German-silver appliances, thus implying that sulphate of copper prevented putrefaction. This we question for several reasons as follows:

Four slides are presented from smears taken from the salivas here reported, collected night and morning, covering a period of six to nine weeks; two of these were made from the dark precipitate collecting at the bottom of the jar; the other two from the whole specimen after thoroughly shaking the bottle, and you will note there are no crystals present (Fig. 4).

We were told by Dr. Ferris that his method is to have the child fill the spitcup in one or two sittings with enough saliva for analysis, which, of course, precludes the possibility of any quantity of metallic waste being present, even if very active chemical changes were occurring, and if there are no crystals present in a composite of nine-weeks' saliva, it is hardly likely they can be detected in one-hour's saliva.

This is the very reason why the analyses failed (reported in last year's papers) to show any metal present; the most careful chemical work and the spark spectra test all giving negative results.

It is hard to conceive of so much metallic waste from German silver as to produce precipitation of copper sulphate crystals visible by the microscope, and if such were present the presence of the salt would be readily detected by chemical reagents.

Quoting Dr. Ferris again (*Dental Cosmos*, *Ibid.*), Dr. Dexter at his suggestion put a band (presumably German silver) "which had been worn three weeks, into a gelatin culture and found a negative result after incubation. He took the band again, scraped off the surface, put the scrapings in a gelatin culture and the band in another gelatin culture, introduced both into the incubator at the same time and found that the scrapings had developed bacteria, the band none." This is an interesting confirmation of the bacteriological work reported in last year's paper, where similar tests of new bands and arches proved negative, proving some action on the *new* metal. It is a further confirmation that the salts found on appliances are inert as germicides, because the scrapings containing these salts, together with the contained filth from the crypts in the metal, produced growth in a gelatin culture.

In the light of the foregoing, it is difficult to explain just what prevents fermentation in the dirty salivas of children wearing German-silver appliances. It has been shown that copper does not exist in more than one in forty thousand parts; that the zinc salt is organic and hence inert; that the action is produced by the fresh metal and not by the (sulphids) salts depositing on it, and we are at a loss to explain such phenomena.

Fitzgerald recently in the *Mechanical and Chemical Journal*, after minute research in copper, claims that copper to the dilution of one in two million will prevent fermentation: just how such dilutions are detected we can not say.

It was tentatively suggested in my last paper that we *might* account for the absence of copper in the saliva from the fact that as soon as the copper ion was liberated by electrolysis it was attacked by the ever-present hydrogen disulphid (H_2S), produced by decomposition of nitrogenous food, and deposited immediately on teeth and appliances as an insoluble sulphid.

Some facts are assured, however: *There is metallic waste from German silver which is ingested, and the saliva is profoundly modified,* acting to prevent fermentation indefinitely, and we can feel assured that any such agent will absolutely interfere with the enzyme ptyalin which physiologically, not long since, was considered of little moment in digestive processes, for while it was known that the food containing ptyalin passed directly into the acid media of the stomach, it was also known that acids neutralized the action of enzymes. But it was overlooked, as Howell ("Physiology") has lately explained, that the mass of food collecting in the esophageal end of the stomach is protected by its bulk from the hydrochloric acid present, and that fully two hours of salivary digestion by enzymes occurs before the stomach fluids begin their work.

So any appliance wasting metal placed in the mouth which interferes with such an important digestive process, as we are assured preservative salivary changes such as have been mentioned, will, is a serious matter.

Prophylaxis and Prevention of Enamel Decalcification.

The value of silver nitrate in the prevention of enamel decalcification is a question which can well be discussed at this time.

The subject is not new. For years Stebbins, L. C. Bryan, Hart and others have advocated its use in operative dentistry as a prophylactic measure, and recently Conrad has clinically explained his methods to many societies.

The writer regrets exceedingly that Dr. Conrad could not accept this Society's invitation to be present and show specimens of teeth treated with his solutions in the mouth, that we might know just what happens to the enamel surfaces.

We can not for a moment undervalue Dr. Conrad's work, and there is no question but that his methods applied to orthodontic cases will produce results. These results, however, must first be submitted to the microscopist to prove that no staining occurs: to the pathologist and chemist to prove that the dental tissues are benefited and the mouth tissues and delicate mouth fluids are not harmed; finally, to the toxocologist, that no systemic effects arise from the continued use of nitrate of silver by the operator, and, more particularly, by the patient.

A study of the action of silver nitrate can only be made by considering its differing effects on the wet and dry enamel. Out of the mouths in very dilute solutions it has long been a standard tissue stain used by histologists; on short exposure no doubt is possible of the deep staining qualities on the dried and cleaned tooth structure. A dry tooth with enamel decalcification and faults, if placed in nitrate of silver solution, even when not prepared and cleaned, will stain in the inter-rod substance because the mucus plugging such spaces in drying contracts and does not coagulate.

A freshly extracted tooth with enamel defects covered by mucus and placed in silver-nitrate solution *will not* stain in the slight enamel decalcification, because the spaces between the enamel rods existing in such are plugged by mucus, which coagulates into an insoluble coating, and it is to this coagulating power primarily, and sterilizing power secondarily, of the mucus in the saliva that we owe the prophylactic action of silver nitrate; it acts then by coagulating the mucus and preventing the carbohydrate pabulum from reaching the bacteria in the gelatinous plaque.

Just a word may be pardoned here on the question of the mucus in the saliva, because it is such an important factor in prophylaxis generally in which all orthodontists are interested.

All enamel surfaces, except those exposed to morsal and incisal stress, are covered in the mouth by a layer of mucus which we here accent exists independently in the saliva in ropes, and hence deposits on all surfaces.

The parotids are the only salivary glands not secreting mucus, and enormous quantities are produced by the mucous glands of the mouth epithelium; it is Nature's protector of all epithelial surfaces, a thick layer lining the gastro-intestinal tract; normally alkaline in reaction, almost impenetrable by acids, it seems a reasonable conclusion that this is Nature's own protection for that product of the epithelium, the enamel of the teeth; its alkalinity, its coagulation when attacked by acid, its colloid consistence preventing disintegration by electrolytic dissociation, as only the colloids can, are all ideal for a guard against acid disintegration.

A. Hugenschmidt (*Cosmos*, 1906, "Experimental Study of the Different Modes of Protection of the Oral Cavity against Pathogenic Bacteria"), speaks highly of the mouth mucus as a protective agent, and quotes Wurtz's and Lemoyez's tests of nasal mucus, three-hours' contact of which with *Anthrax*, *Staphylococus aureus*, *Streptococcus* and *Colon Bacilli* destroyed the *Anthrax* spores and attenuated the others. Widal says of bronchial mucus as does Stroganoff of the mucus of the cervix uteri, that it acts first mechanically, gluing the spores together away from their habitat; secondly, as a direct bactericidal agent toward microbes.

Others might be quoted were there time, and it is the writer's firm conviction that normal mucus is Nature's own protection for enamel surfaces; of course, body dyscrasias will affect this secretion, producing acidity. The fact that the gelatinous plaque makes the buccal mucus its attachment to enamel surfaces does not militate against the protective action of mucus on the enamel, for it must be remembered that the teeth of all immunes are likewise covered with mucus and always have been, and that if mucus were destructive rather than preservative of enamel continuity teeth in our race would cease to exist, so thoroughly are they encased by it. The fault is to be found in the variation from the normal in mucus, which permits the plaque, or better still, the carbohydrate media, to reach the bacteria on enamel surfaces.

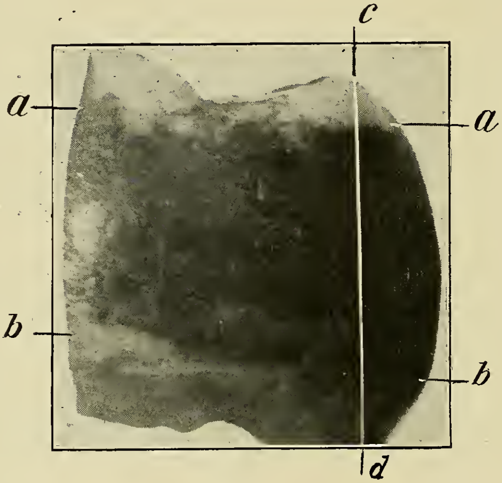

FIG. 5.

Fig. 5—Disto-palatal angle of temporary molar decalcified, cleaned up in the mouth, to which rubber dam was applied and coated with silver-nitrate solution. Note the well-marked outline (a) and (b) where the uncemented band surrounded the tooth.

So, when decalcified spots occur and we are told that they are polished out and disappear, we know it is *impossible* to polish out effectually decalcified enamel without getting down to dentine ("Base *versus* Noble Metal Appliances in Orthodontia, ITEMS, May, 1909, also Fig. 6). What really happens is that on the removal of the cause for acidity (the appliances), the open spaces between the enamel rods become plugged with mucus and refraction is broken, the light reflecting from these surfaces as from normal enamel.

If such enamel surfaces receive the thorough massage with pumice and wood by hand that Dr. D. D. Smith gives, and are then cleaned with ammonia and alcohol and placed in the rubber dam, and, according to L. C. Bryan's method, soaked in nitrate of silver solution, *these spots will stain* (Fig. 5 and 6).

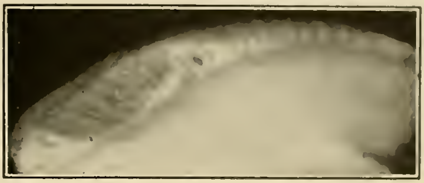

FIG. 6

Fig. 6—Ground section of molar shown in Fig. 5 on the line (c) and (d) showing how deeply the silver-nitrate solution penetrated the decalcified inter-rod substance when such is thoroughly cleaned up and desiccated even when applied in the mouth.

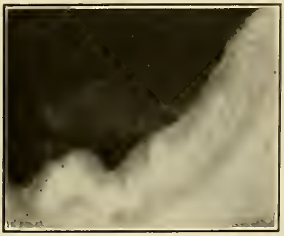

FIG. 7.

Fig. 7—Decalcified enamel showing all the staining possible after prophylaxis of the surfaces one day, and the application on the next day of the silver-nitrate solution. This surface was simply wiped dry and blown off by air at 15 pounds pressure without the use of other desiccants or the rubber dam.

If these spots are not so treated, but the tooth dried in the ordinary way is simply wiped with the solution, *they will not stain* (Fig. 7), and those who state that they do thorough prophylaxis where there is enamel decalcification and apply silver nitrate and do not stain enamel, *do not do perfect prophylaxis*—if by such is meant the removal of all the mucus covering of the teeth.

The best results, from the use of silver nitrate will therefore be obtained, first, by most thorough massage of the enamel surfaces after the method of Dr. D. D. Smith; the patient is then dismissed for twenty-four hours, when the teeth are dried as thoroughly as possible without the rubber dam, and coated with a solution of from 10 to 20 per cent. silver nitrate, according to the carious tendency of the mouth, on which will also depend the frequency with which this treatment is applied, varying from every two weeks to once a month, or even less frequently.

While silver nitrate coagulates the freshly deposited mucus—and that is the reason for the delay of twenty-four hours, and staining is liable to occur if the solutions are applied to dry surfaces at once after cleaning—and while we know by coagulation it will prevent the carbohydrate media from reaching the plaques, should any be not removed by hand massage it would be the height of folly to say that thick layers of mucus loaded with food débris could be coagulated and caries prevented. The writer wishes to go on record as an absolute believer in prophylaxis as it is now practiced, and we can all pin our faith in the efficacy of elbow-grease and "clean up," *but clean up will not do all,* as the following will show:

One of the most interesting developments growing out of the inquiries preparatory to this report was the fact noted by several "that those children receiving the most careful and regular prophylactic treatment were more liable to enamel decalcification about applianes than those only receiving a moderate amount." *That apparently the more thorough the clean-up the greater the enamel decalcification.* This would seem to indicate a loss of something: that some protective process had been interfered with.

The writer believes (he does not ask you to believe) that the protective covering lost was the oral mucus; that by its thorough removal new surfaces were laid open to fresh carious infection; that had nitrate of silver been used after a day's mucus had collected, fresh cultures could never have prospered.

What he does ask of you is this: The Orthodontist's opportunity for observation as to the value of prophylaxis is unique, for he is daily noting the behavior of enamel, adjacent to which he has also made retention centers by placing appliances, and if the members of this Society will, by careful observation, confirm or deny the foregoing statemtnt, *i. e.,* that enamel decalcification is greater near appliances after prophylaxis regularly applied than in those which are not so treated, he will be conferring an everlasting favor on the profession at large, for in this lies the very "crux" of the whole great and yet unsettled question of dental caries.

Conclusion. That the noble metals only, are fit for appliances in the human mouth.

That while there is greater danger of enamel decalcification from noble than base metal appliance, this is only early in their application, and it may be met by intelligent prophylaxis, whereas the objections to the base metal can not be overcome, for the crypts increase and the whole appliance becomes a retainer of filth applied to the enamel.

That ligatures should be used as little as possible, if at all, and that appliances should be of the removable type, if possible.

That every retention center between tooth and appliance should be covered by protective bands.

That some gutta-percha preparation take the place of oxyphosphate, or be used in conjunction with it.

That prophylaxis is necessary, but will not alone prevent decalcification, and may induce it.

That silver-nitrate solution should follow the thorough Smith treatment by coagulating the buccal mucus, protects and does not stain the tooth enamel unless defects are of such depth as to call for operative procedure.

Discussion of Paper by Dr. Clarence Grieves.

Dr. Pullen. I am sorry I could not have had this paper to read in advance in order to keep in mind the particular points which the essayist makes, so as to be able to discuss it to better advantage. There are some things of which he has spoken which interest me exceedingly; *i. e.*, in relation to the practical use of the metals in the mouth. Many of the members of the American Society have been using the noble metals exclusively for the last few years, and they have found that by combining prophylactic methods with their operating, greater success has attended their efforts. Many problems present themselves which are difficult to solve, such as the proper prophylactic methods to use, etc. Again, in some cases, I have noticed staining from silver nitrate and did not know how to avoid it, but the technique which Dr. Grieves has presented to-day throws a new light on that matter. The nearer we can approach to an appliance which allows space between the teeth and the arches, without the use of many ligatures, the easier the tooth surfaces can be kept clean. I am very much in favor of having Dr. Grieves continue his investigations, and I recognize that he has already given us much that is of value in regard to the use of the noble metals in the mouth. No doubt the members will be glad to send him specimens from time to time and his report next year will again be invaluable to us.

Dr. Ketcham. I have not anything to say except to congratulate Dr. Grieves. His work is splendid and should have been taken up long ago, and we should be proud of having such work so thoroughly done for us. I am sure we are all deriving the greatest benefit from his researches.

Dr. V. E. Barnes. Dr. Grieves has given us a most excellent paper and we will not want to dispute or deny the metal tests. However, since my clinical experience for over ten years has been such as to make me fear the universal use of noble metals for orthodontia appliances, and since this paper has not gone definitely into the alleged deleterious effects which may arise from the use of German silver, I can not see that we are much ahead on this subject. I have noted that a platinum appliance, soldered with pure gold, was often associated with decay. At one time when I had taken up the use of platinum and pure gold, especially for retainers, I thought that I had an excellent fixture for all purposes except spring wire, but, when decay came, in spite of the care of the patient and myself, I felt compelled to return to German silver for general purposes. I had noted superficial disintegration under gold-plated appliances and, therefore, used unplated German silver and the decay, even in neglected conditions, has been checked.

The doctor has said that "the metal salts taken up by the saliva and carried to the stomach prevent fermentation and undoubtedly cause great damage." That opens a comparatively new field. The experts at Johns Hopkins are only opening their eyes to the possibilities in this direction. German silver is an evil, but is not the noble-metal appliance advocated a greater evil? It is not yet demonstrated that gold or platinum is better than German silver for practical purposes and results in all cases. If we are to have decay under the noble metals, and must resort to silver nitrate, we are using questionably strong reagents in the mouth, which are liable to destroy normal conditions as well as the abnormal; we destroy or weaken the very resistive features desired. It has not been proven that the discolored German silver in the mouth is a detrimental agent. Let us not jump from the "frying-pan into the fire." We need little more theorizing and observation, and we then will get our practical metal for appliances.

I have noted where we have a German-silver band in place, for instance, on a molar, there is no decay occurring on the approximal surfaces. In that portion of the mouth there is no circulation; there can be no real prophylaxis. If prophylaxis under the gold appliance is to be efficient, it must be efficient at that point as well as upon the buccal and lingual surfaces, and if it fails in this regard the use of the noble metal is a failure. Our research must take this direction; it must find a metal, the slight disintegration of which must be at the expense of the metal and not of the tooth. It should produce a salt which shall be inert. That hypothesis does not call for all noble metals.

I wish to thank Dr. Grieves for what he has done. His work so far is of extreme value. My remarks are not to belittle his effort in the least. I would like to know the effects of the salts of the German-silver alloy upon the system from actual tests instead of from surmise. We need some investigation similar to the X-ray-bismuth tests on digestion.

Dr. Ottolengui. I am glad I am called immediately after Dr. Barnes, because I can not follow what he has said. I do not believe that one thing he said in favor of German silver and against the noble metals is true. It was proven last year that there is a reason for not using German silver, in that it disintegrates and, therefore, loses its tensile strength. That is especially objectionable in retaining devices. As to gold appliances not holding their own, that is not true, because they are holding their own better than the German silver. I want to remind Dr. Barnes that Dr. Grieves pointed out last year that the disintegration of German silver discharges into the saliva poisonous doses of salts.

Dr. Grieves. That was my impression when worn for some time in the human mouth.

Dr. Ottolengui. Someone wrote me a letter in which the contention was made that the quantity which Dr. Grieves considered deleterious is really less than the medicinal dose of the salt. I wrote him that before publishing that criticism I would like to ask him whether he would not discriminate between giving his sick child a medicinal dose of a poison, and administering to his well child, one half of that dose daily, for an unlimited time I believe we do not know just what damage we do to the system by the constant exhibition of these poisons entering the system through the use of these metals. This alone would be a sufficient reason for discontinuing the use of any metals which can throw down such salts.

In regard to the decay of the teeth in contact with metals I think it has been abundantly proven that it is not the metal at all, but that the decay is invited by the creation of a retention center, and we may have the same conditions with any metal, in which case there would be the same extent of caries in that particular mouth. None of us has given Dr. Grieves the support which he should have had. He has not had enough specimens nor sufficient data. In the specimen I sent him you will find it is not sufficiently disintegrated even to require a filling. It had been in the mouth a year prior to the request of Dr. Grieves that we give him such specimens. They were retention bands, worn for a year on the temporary molars. One of these bands had loosened and was lifted off; the other tooth was extracted with band still held fast by cement. They have proved interesting. The disintegration under the loosened band was superficial, and proves the need of a good cementing medium rather than an injurious influence of metal.

Another point to be considered (if you argue in favor of German silver) by any of you who use labial retention arches, is, what are you making them of? Are you using German silver? If you use the noble metals in this, the most conspicuous place in the mouth, you can use the noble metals anywhere. When I use such arches crossing the labial surfaces I allow them to come in contact with the tooth surfaces as little as possible, and tell the parents that I refuse to take the responsibility for any caries which might occur under the wires unless those teeth are cleansed by passing silk ligatures under these wires at every cleaning, and I demand that the teeth be cleaned three times a day or immediately after eating. It is not the metal which produces trouble; it is the lack of oral hygiene. In some children anything remains clean in the mouth. It is a serious question as to the care and cleanliness exhibited when any metal is kept for a long time in contact with the teeth. I think it advisable where the child is not cleanly, and can not be made cleanly, to take special precautions. In some mouths where there is an extra exudation of mucus of a mucilaginous character, which holds a detritis about the gum margin, I feel safer to use an iridio-platinum jacket, rolling the material almost as thin as that used for matrices for inlays. That protects the tooth from contact with the arch—not because the arch is of gold, nor German silver, but because in such mouth decay might occur with any metal used.

Dr. Barnes. I would like to correct the impression Dr. Ottolengui has. I stated that noble metals were negative in their action. With German silver there is something which prevents decay. There is a question as to the effects produced upon some systems. I do use noble metals in the incisor and cuspids regions where cleanliness may be maintained, but I warn the patients that those teeth and bands *must be kept clean.*

Dr. Ottolengui. I contest that statement so often made. Neither Dr. Barnes, nor any other man, has yet *proved* that there really is *"something"* about German silver that prevents decay.

Will Dr. Barnes or Dr. Grieves tell me, if our orthodontia appliances invite caries, why do we not have caries along the approximal surfaces where we apply ligatures all the time? I have yet to see an approximal decay in either an incisor or cuspid of any child for whom I have been regulating teeth. But I have seen very much approximal decay in children who were not wearing any appliances.

Dr. Barnes. You have no circulation of fluids there, and the salts from German silver remain active.

Dr. Ottolengui. Then we should have caries when we use silk ligatures, which surely do not throw down metallic salts. Do you mean me to understand that if the teeth are not cleaned they are more immune to decay than where they are cleaned?

Dr. Barnes. Sometimes that seems to be true with base-metal appliances.

Dr. Ottolengui. The truth is, that the approximal surfaces are cleaned by placing or removing ligatures.

Dr. Hawley. It will require several years, I believe, for us to fully appreciate the work Dr. Grieves has done for this society. No man has done better work nor presented more valuable data to this society. I want to express my appreciation. He has established definitely certain things, and it will take long, careful and scientific observations to change those conclusions. All of my clinical experience has led me to practically the same conclusions which he has reached through his scientific investigation. The fact that German silver deteriorates in the mouth in retention, and during treatment as well, led me to abandon it before he gave us his results, and I have not as yet observed any more decay under gold appliances than I had observed under the German silver. From my observation I believe that any mouth that will not be cleaned sufficiently to prevent any deterioration of the enamel under gold appliances, should not be treated. Any child that will undertake such a coarse of treatment for a case of malocclusion must be taught to clean the teeth sufficiently to protect them under any appliances.

Gold has many advantages besides being free from throwing out deleterious substances in the mouth; precious metals are stronger and can be used thinner, and are more sightly. In comparison to using a large German-silver arch (and when you use smaller than 16 gauge in German silver you lose resiliency), we can use 18 gauge in gold and have great strength and resiliency. I think I have noticed, although I can not present any definite data, that the extreme prophylaxis; *i. e.*, the polishing of the teeth with pumice stone with the aid of orange wood stick, etc., during the orthodontia work, is not any more valuable than the thorough cleaning with the brush, leaving some mucus and using nitrate of silver. I started some experiments with a solution of sticky wax, resin, etc., but unfortunately I was not able to collect those teeth finally through a series of neglect (some on my part and some on the part of the patient), but I intended to get a series of temporary teeth that would be lost, and coat them with these solutions, and see how long that would protect them. It remains on the teeth for a long time, can easily be renewed at intervals of a month or two, and I believe it would be of great value. I have lost all fear of any deleterious effect from the noble metal appliance. If the child can not be taught to keep the teeth clean there is little use in treating the case.

Dr. Kemple. I believe the two papers Dr. Grieves has presented are among the most important that have ever been read before the American Society of Orthodontists. Dr. Grieves started to investigate a problem along purely scientific lines. He did not begin this work with the purpose of advocating the use of any particular metal or alloy, but has simply been making a series of investigations to find out what possible effect the saliva may have on those metals commonly used in the construction of regulating appliances, and if possible what protection from decay the teeth may receive from the salts thrown down by those appliances during orthodontic operations. He has also shown in his last investigation that the salt of copper is not proven to be a preventive of caries of the teeth, as has been claimed. What the physiological effect of the assimilation of small quantities of zinc—which have been found in the saliva of patients wearing the German-silver appliances—may be, he does not know. None of us know, and it is up to the physiologists to determine it. Possibly the idiosyncrasies of the patient may be such that a very small proportion of these salts may be injurious.

We have all heard of one or two patients who have been more or less ill while wearing regulating appliances, the illness being of an obscure origin, but upon removal of the appliances the patient immediately improved in health. Such conditions may not result from wearing the appliances; they may be only coincident; but of this we are not absolutely sure: it is a problem to be solved by the pathologist. However, if such idiosyncrasies do exist among our patients making it possible that even one in a hundred, or even one in one thousand, is liable to suffer from metallic poisoning by wearing regulating appliances, we, as orthodontists, want to know. Its effect may not be manifested at all in the great majority of patients, but if the assimilation of zinc is injurious to one patient in a thousand, how shall we tell which patient it is? Up to date we have not an ideal metal for appliances, and Dr. Grieves wishes the investigation to be carried further. In regard to the production of caries in a mouth that is neglected (and I believe Dr. Grieves will confirm this, or did confirm it in the paper at Washington), the tendency to decay is less where German-silver or base-metal appliances are used than in a mouth where the noble-metal appliances are used. It has been my observation that in a mouth which is kept ordinarily clean (as the better class of patients usually keep their mouths), there is very little, if any, more tendency to decay with the noble metals than there is under the base metals. So far as the working of the metals is concerned and the cleanliness of the mouth, it is of advantage to both patient and operator to use the noble metals. Experience has shown that the German-silver appliances in use are not composed of an alloy to give permanency. Recently a patient telephoned me that an appliance had come off. She had been away—in Europe—for a number of months, and she came to me to have the appliance replaced. Both of the upper molar bands on the approximal surfaces were disintegrated to such an extent that they simply dropped to pieces. You could not handle them without parts crumbling off. It was not a disintegration of the cement, but of the metal itself.

I just want to express my hearty appreciation of the effort that Dr. Grieves has made to arrive at the truth. He has not been opposed to German-silver appliances, nor has he advocated the use of noble metals. He is seeking for facts from an unbiased and unprejudiced standpoint.

Dr. Munroe. I would like to give an experience I had in the use of the German-silver appliances after having had the patient wear the appliance for a period of about eight months. While the orthodontic work went along very nicely, the patient became affected in some way which we could not exactly explain, and upon the advice of the family physician—not seeing any other cause after examining the case very carefully—the appliances were removed. The boy had been affected with something bordering upon epilepsy, and on the removal of the appliances the patient commenced to recover. Whether it was the nervous tension on the child or whther it might have been the result of the salts deposited in his system from the appliances, I do not know. I have not yet resumed the work in this case.

I have also lately noticed, in regard to the immunity from caries in the mouths of patients, that sulphocyanate of potash has some effect: the degree of immunity is in accord with the amount of the potash. Can Dr. Grieves tell us if that would be true in the mouths of patients who wore the appliances where decay is present?

Dr. Hawley. I presume all the members are now familiar with the use of the so-called grass line, or raw silk, but I will say that the longer I use this grass line the better I like it. In connection with the noble metals it has no staining effect. I like to use as few ligatures as possible, and will show a device in the clinic which does away with a number of ligatures. A few days ago I had occasion to remove a grass-line ligature that had been overlooked and had been in the place about nine months, and the tooth was not injured, nor was the ligature disintegrated. It is a much more permanent ligature than I had supposed.

Dr. Kemple. In regard to ligatures, and particularly in regard to the so-called grass-line ligature, I would like to say I have had a number of cases where I attempted to rotate the lower incisors with the silk, and in mouths where there is slight tendency to caries, I have found, upon the removal of one of those ligatures which may have been in place for two or three weeks, the enamel bleached, forming a line just under the ligature. This bleaching was not sufficient to cause caries in that length of time, but enough to warn me that I could not leave silk ligatures on those teeth. I have not had this occur with any teeth except the lower incisors. I have noticed it, perhaps, a half dozen times, or more. I just wanted to call attention to that because a number of the members have spoken about leaving the ligatures on the teeth for quite a long time without any injury. I do not think that can be done indiscriminately without injury to the teeth. If whitening of the enamel is shown even in three to six weeks, I think we should be cautious with the silk ligature.

Dr. Dunn. Since Dr. Grieves's paper was presented last year, I have been trying both the noble metals and the German silver. I am favorably inclined to the noble metals, and yet I am not prepared to-day to give up my German-silver appliances. I think there are cases where each metal is indicated, or that each appliance should be made of German silver or of the noble metals entire. In one of my worst cases where there was disintegration, noble metal appliances were used. In no case where German silver was used did I have any such experience.

Dr. Kemple. Have you not seen similar conditions in the mouths of patients who were not wearing any appliances?

Dr. Dunn. Yes, I have seen the same condition; but I believe in this instance the appliances were in a measure to blame.

Dr. Kemple. Perhaps that is a coincidence.

Dr. Dunn. The disintegration of the German silver is proven, but I have not had my appliances disintegrate to the point where they have been a detriment. From the esthetic standpoint that feature is against them.

I can not see any advantage in silk ligatures, except in certain places, as in the rotation of incisors, where they are in slight torso-occlusion. Dr. Grieves spoke of using removable appliances, and not using ligatures of any sort. I do not believe the time will come when we can do that. We will always be compelled to use ligatures and stationary appliances in the mouth.

Dr. Grieves. I appreciate very much your consideration of the paper I have read, and I want to thank those members who have asked me to go on with the work. I feel I am at the "end of my string!" I have had the best help I could get in chemistry from others. If I had been a biased man and opposed to German silver, I would simply quote Dr. Ferris's statement, where he refers to seeing crystals of copper sulphate, and let it go at that; but I think that will hardly do. I hope you will not think I am biased either way, and I am not an orthodontist.

Relative to the amount of waste, we certainly know that the saliva is wonderfully changed. You know the filthy mouths of orthodontia patients, and if you will collect saliva of your own or of your patients and keep it over night, and then think of keeping it three months, as I did, it will speak for itself. When you find saliva reeking with filth and food and not decomposing, something has happened to it, and the thing that has happened to it is so profound as to completely change its character so much so as to affect the ptyalin or the enzymes in it. That point must be recognized. I have the verbal assurance of a good physiologist that ptyalin, on which we depend for digestion of starches, has a full two hours in the esophageal end of the stomach to do its work. Any thing which will interfere with the ptyalin digestion is no small matter. We are sure that German silver does waste. It has been proven by weight and by experience, *and the waste which we can gather from the appliances and from the teeth is absolutely inert as a bactericidal agent.* Sulphides of copper, with the containing filth, were put in the culture and a growth was secured from the scrapings. If we want salts formed, we are not getting them in a germicidal way from German silver, as was stated last night and proved this afternoon. As to the ingestion of the waste metal and what harm it might do, we may swing first to the one side and then to the other. I quoted cases where there were serious systemic conditions, and where, upon the removal of the German-silver appliances, those systemic conditions ceased. It may have been coincidence, and it may not have been coincidence. But we know the metal wasted. The *physician ordered the removal of the appliance, however.* I have been "right up against" that proposition and know how I felt in view of the fact that we are teaching and practicing prophylaxis and still put something in the mouth which the physician has to order out. If we pose as "one end" of the medical profession, and use something which, when removed, seems to allow the sick patient to recover, we might better not use that substance thereafter.

As to prophylaxis, Dr. Barnes has mentioned the fact that German silver does no more harm than gold. I found that when gold was first put in the mouth the damage was done. There was no damage when German silver was first placed in the mouth. After the end of the first month we may have decalcification of the enamel beginning, and it increases until more damage is done than when the gold is used. Of course, we had more cultures applied directly to the tooth by the band than from smooth, clean gold, or noble-metal appliances free from zinc.

Twenty karat platinous gold with zinc degenerates. I mean, therefore, by noble-metal appliances, such alloys as gold and platinum with copper or silver, but no zinc or base metal. Why should we clean teeth if we place bands on them to degenerate and get filthy?

Relative to the salts ingested, the work I reported last year shows the nickel can absolutely be neglected, German silver being copper 2, zinc 6, and nickel 1. There was one case of an adult suffering from pernicious anemia that my own physician showed me, where the appliances had been on three years, and after removal of same the patient recovered. It may have been coincidence. The appliances were much damaged. In the case of a daughter of a member of this society the symptoms were colic, constipation and diarrhea. As to the absorption of copper, it is taken up directly by the membrane, thence attaching itself to the red blood corpuscles, and finally lodged in the liver. It is a normal constituent of some foods, and ingested in that way it does no harm. In the case of brass-founders' ague, the patient becomes green, has colic, chorea, and a general breakdown of the *central nervous* system and interstitial membranes of the kidneys, by which it is excreted.

I think I have answered all the questions, and the reason I suggested the nitrate of silver was that I really believe it is a good thing, and Dr. Barnes must not misunderstand me. I did not say it must not be used by the patient. The teeth may be left one day: remove all the detritus and mucus and let them rest a day for the mucus to accumulate, and then make the application.

Dr. Barnes. What about the interproximal spaces?

Dr. Grieves. I do not know how they would ever be approached by prophylaxis anyway. That is no argument against prophylaxis. How do you reach those places ordinarily? You do not. Silver nitrate is just as effective, and you will need it more than if you use gold, because the German silver is plated.

Dr. Munroe. What about the sulphocyanates?

Dr. Grieves. These have been worked out by Dr. Beach and Dr. Lowe, and they have been giving the sulphocyanates. It has been proven, I think, that from two to five per cent. of sulphocyanate, potassium or sodium, in the saliva will prevent decay. As to the administration of it I do not know offhand.

Dr. Munroe. Would that hold good with the appliances in the mouth?

Dr. Grieves. I can not say more at this time. I think it has been proven that gold is clean and should be used, and that German silver at first may have some deterrent action, and later it does more harm than gold. The salts from German silver do no good, and they might do great damage. In conjunction with the prophylactic measure of using the silver nitrate the practical results have been worked out, and I particularly ask you to note whether you have degeneration after perfect prophylaxis, more than you had before. You are in a position, gentlemen, to study the beginnings of caries: that is something we know nothing of. You can see these patients from day to day and week by week. You are in a position to solve that, assisted by a little chemical work as it may be worked out by someone more able than I in organic chemistry.

The Laws of Antagonization of the Teeth in Orthodontia.

By Leuman M. Waugh, D.D.S., Buffalo, N. Y.

It will be the endeavor of the writer to review the anatomic features of the temporomandibular articulation as it exists in the *living* human subject, and to direct attention to the definite and positive part it plays in controlling the contact relations of the teeth of the two jaws. From this fundamental study it is hoped to make clear certain essential principles governing the universal arrangement of the teeth, so that normal jaw movement may be carried out with harmonious tooth contact, in accordance with Nature's plan. This, in the writer's mind, will supply the basis from which will be evolved a broader and truer science of orthodontia, by which he obviated the present-day perplexing problems of treatment and retention, and of supra- and infra-occlusion.

As dental nomenclature has not been reduced to a science, it will be best first to define a few terms as they will be used in the paper.

Definition of Terms.

"Antagonization," will imply the contact relations existing between the teeth while the mandible is in motion, or, in other words, when either or both condyles have been moved from their resting position in the temporomandibular joint.

"Articulation" will be restricted in use to the description of the temporomandibular joint.

"*Occlusion*" will imply the contact relations existing when the teeth of the upper and lower jaws are shut and the mandible is at rest.

"*Normal occlusion*" is possible only with an ideal arrangement of the teeth.

"*Natural occlusion*" will imply occlusion with either normal or abnormal arrangement of the teeth.

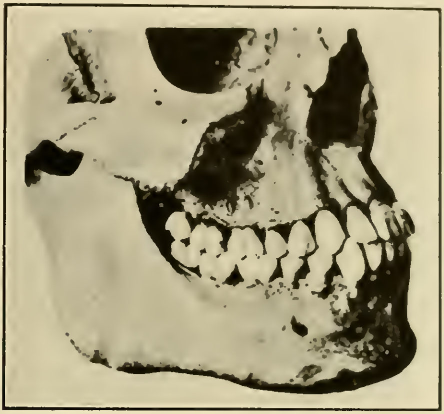

Fig. 1.

Fig. 1.—Normal occlusion from buccal aspect. Note the interdigitation of the buccal cusps, the overlap and the buccal compensating curve.—(Broomell.)

"*Overbite* will imply the distance from the lingual surfaces of the upper anterior teeth to the labial surfaces of the lower anterior teeth when the jaws are closed.

"*Overlap*" will imply the distance that the upper anterior teeth extend down over the lower anterior teeth when the jaws are closed.

Occlusion. It will be best to first briefly review occlusion. Normal occlusion, it should be remembered, must be regarded as an ideal condition, but rarely found in any type of individual (Fig. 1). A knowledge of this perfect arrangement is of the utmost value, not alone in orthodontia, but in every branch of dentistry, and has practical application from the period at which the deciduous teeth are fully erupted to the time when the construction of complete artificial dentures becomes necessary.

In studying the occlusion of the lateral half of the jaws, it will be observed that each tooth has two antagonists in the opposite arch, except the lower central incisors and the upper third molars (Fig. 2). In the incisors and cuspids the labial surfaces of the lower rest upon the lingual surfaces of the upper. Bonwill believed that the extent of this overlap corresponds to the depth of the cusps of the bicuspids. This may serve as a general, but not an accurate, guide, as will be understood later.

The bicuspids and molars on each side, viewed collectively, consist of a series of cones or cusps, bounding fossæ or depressions (Fig. 3). These are so fitted together when the teeth are in occlusion that the fossæ receive cusps of the opposing teeth, forming some thirty mortars and pestles for the trituration of food. The line of the lingual cusps of the upper are received into the groove between the buccal and lingual cusps of the lower, while the buccal line of cusps of the lower are correspondingly received into fossæ of the upper. The lingual cusp of the first upper bicuspid is received between the buccal and lingual cusps of the two lower bicuspids, its point corresponding to the line between the mesial marginal ridge of the second, and the distal marginal ridge of the first.

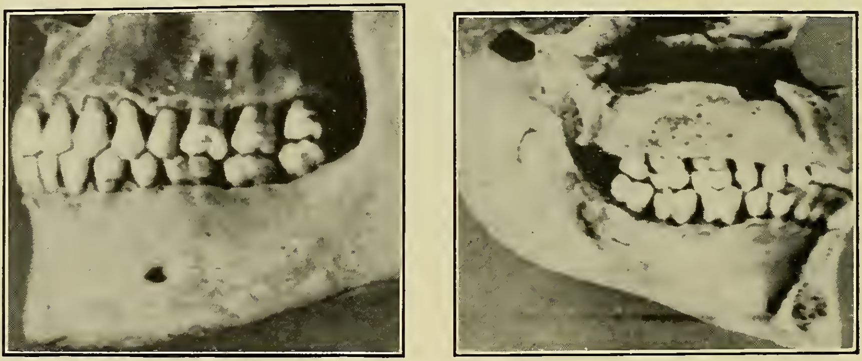

FIG. 2 (BUCCAL). FIG. 2 (LINGUAL).

Fig. 2.—Occlusion from both buccal and lingual aspects, showing some thirty mortars and pestles for the trituration of food.—(Turner, from a skull in the Wistar Institute of Anatomy.)

The lingual cusps of all the posterior teeth interdigitate more or less similarly. The inclined planes antagonize those of two opposing teeth, except the upper third molar, which contacts but one tooth, the distal planes of the posterior cusps being disengaged. The summit of the buccal cusp of the upper first bicuspid is placed on a line with the interproximal space between the two lower bicuspids and to the buccal side.

The general arrangement of the second bicuspid and molars is relatively similar. The lower third molar contacts two upper molars.

Antagonization.

The *antagonization* of the teeth is a mechanical problem, and its comprehension necessitates an understanding of the universal anatomic peculiarities of the temporo-mandibular articulation and the *resulting* movements of the mandible as they exist in the living subject. These joints are complex and bilateral, and afford freer movement of the mandible than exists with any bone in the body. Each of the condyles of the mandible articulates with the glenoid fossa of the corresponding temporal bone (Fig. 4). The fossa is situated at the root of the zygoma, and is a mere depression, *not* corresponding in shape with the condyle which it receives, and which occupies only a part of it, the rear portion of the fossa containing a part of the parotid gland. The articulating surface for the condyle extends forward, beyond the fossa, on to a prominence, the *eminentia articularis*. Here it should be noted that the articulating face is inclined forward and downward (Fig. 5). The condyle is suspended from the temporal bone by means of (Fig. 6): (*a*) the capsular ligament, which is attached below to its neck, and above to the edge of the articulating surface of the fossa and the *eminentia;* (*b*) by the stylo-mandibular ligament, which extends from the styloid process downward and forward to the ramus near its angle; (*c*) the internal lateral ligament, which extends from the spine of the sphenoid to near the posterior dental foramen of the mandible. It will thus be seen that the mandible is permitted free forward move-

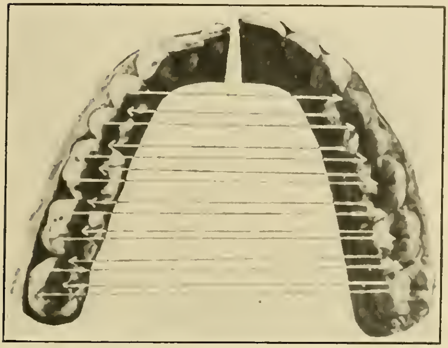

Fig. 3.

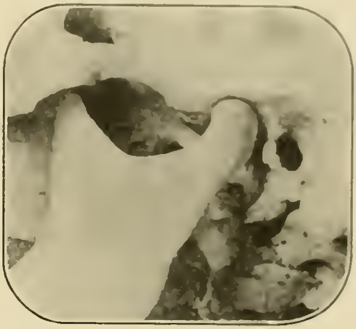

Fig. 4.

Fig. 3—Showing a lateral half of the corresponding upper and lower arches, the arrows designating the positions of the various cusps in occlusion.—Turner.

Fig. 4—Showing the bony relations of the condyle and glenoid fossa.

ment. Its backward movement is controlled by the external lateral ligament (Fig. 7), which arises from the posterior portion of the zygoma, and possibly from the post-glenoid process. This ligament plays an important part in the mechanism of the joint. Interposed between the condyle and the fossæ is the interarticular cartilage (Fig. 8). This is oval in shape, thin in the center—occasionally being perforated—thicker at the edges, especially the posterior, its circumference joining the capsular ligament.

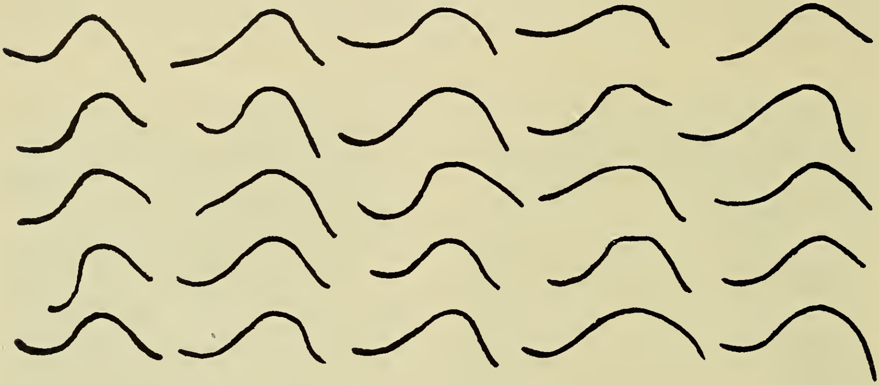

Fig. 5.

Fig. 5—Showing tracings of the lower outline of twenty-five glenoid fossæ, including part of the eminentiæ articularis. Note that the angle of descent varies markedly, yet in all it is forward and downward.

There are two synovial sacs, one below the cartilage, interposed between it and the condyle, the other above the cartilage, placed between it and the fossa. The upper synovial sacs afford a free direct forward movement to the mandible, it being advanced by the external pterygoid muscle, which is inserted into the cartilage and neck of the condyle (Fig. 9). When both external pterygoids contract simultaneously, the two condyles move forward in their respective paths, and the mandible is protruded. If one of them contracts, the condyle is drawn forward in its path, while the one of the opposite side, remaining in its socket, becomes the pivotal point, the mandible being moved laterally. The teeth on the pivotal side pass transversely and almost on a direct bucco-lingual line, while those of the opposite or "excursive" side move forward in the line of the arch with a slight inward curve (Fig. 10).

When the mouth is opened the condyle moves first on the lower synovial sac; then, when the lower edge of the external lateral ligament is rendered tense by the backward swing of the ramus, the point of insertion of its lower edge becomes a new center of motion (Fig. 7).

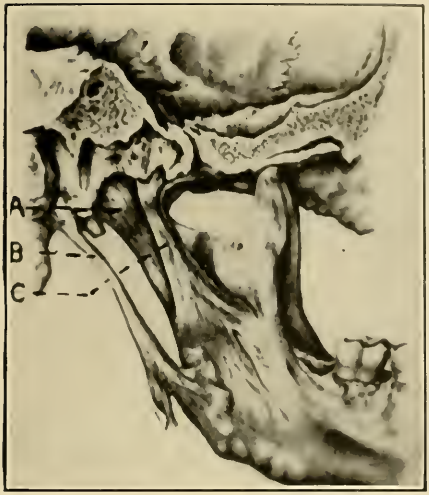

FIG. 6.

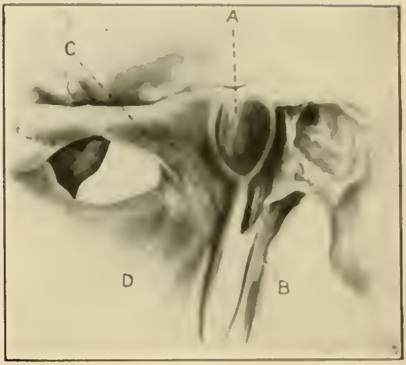

FIG. 7.

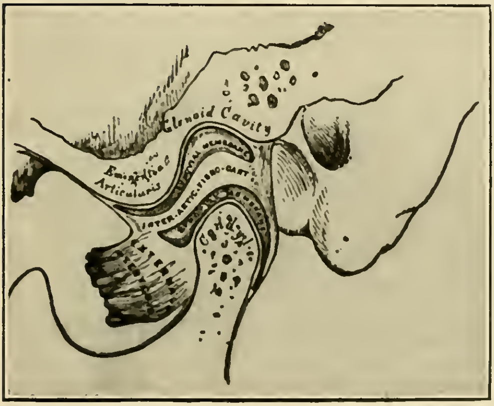

FIG. 8

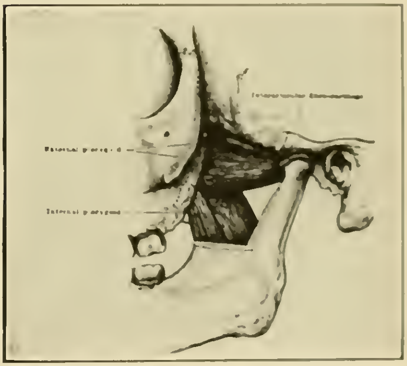

FIG. 9.

Fig. 6—The mandible suspended from the temporal bone, lingual aspect. (a) Capsular ligament; (b) stylomandibular ligament; (c) internal lateral ligament.—(After Deaver.)

Fig. 7.—The mandible suspended from the temporal bone, buccal aspect. (c) External lateral ligament; (a) capsular ligament; (b) stylomandibular ligament; (d) ramus.—(After Deaver.)

Fig. 8.—Vertical section through the temporomandibular articulation.—(Gray.)

Fig. 9.—Temporomandibular articulation. The ramus partly removed to show pterygoid muscles. Note the insertion of the external pterygoid partly into the interarticular cartilage.—(Morris.)

The neck of the condyle turns upon it, and its articulating surface with the interarticular cartilage, moves forward upon the *eminentia articularis.* If the mouth is opened very widely, as in yawning, the condyles pass still farther forward along their respective paths.

Disregarding the topography of the masticating surfaces of the teeth, it will be seen that, in motion, the occlusal surfaces will describe two compensating curves, the one extending antero-posteriorly, "the curve of Spee," and the other passing laterally or at a right angle—more or less—to this (Fig. 12). Therefore, when viewed from the buccal, an imaginary line intersecting the cusps of the upper and lower teeth will be curved, the concavity being upward. This curve, if continued backward, will very frequently coincide with the curve of the condyle path. When viewed from the anterior, it will be found that the lingual cusps of the lower posterior teeth are placed on a lower plane than the buccal cusps, and that the lingual cusps of the upper assume a relatively lower position than their buccal cusps (Fig. 11). *The extent of curvature is dependent upon the descent of the condyle path; therefore,* when its inclination is marked, the compensating curves will be relatively deep (Fig. 30). If the condyle-path were horizontal, there would be no curve in either direction, and the plane of occlusion would be flat and on a parallel with the condyle-path (Fig. 31). If an arc be struck from above, having the same radius as that of the buccal compensating curve,

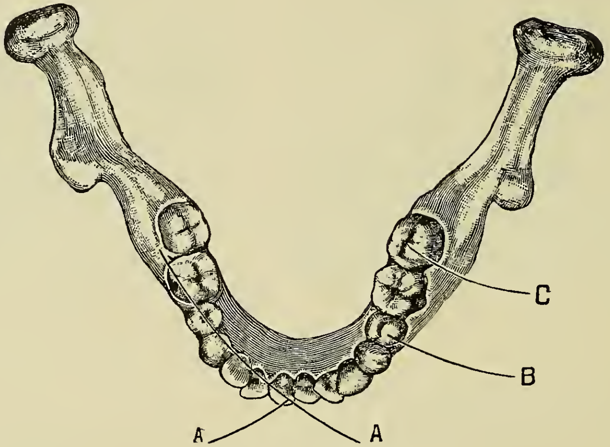

Fig. 10.

Fig. 10.—The mandible showing the occlusal surfaces of the teeth. The lines, a, a, are in the direction of tooth movement on the excursive side, b and c on the pivotal side.—(Snow.)

and from a center located on the median line of the face, it will intersect the tips of the buccal and lingual cusps of the teeth on both sides of the jaw. This is the lateral compensating curve. Please note that the two curves represent arcs of the same sized circle (Fig. 12).

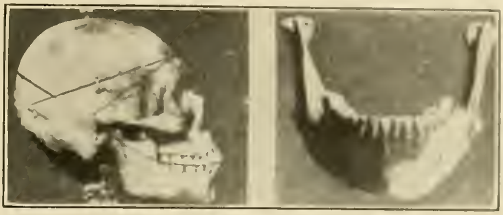

FIG. 11.

Fig. 11—Note in the mandible on right the lingual inclination of the occlusal surfaces of the molars and bicuspids.—Prothero, *Dental Review.*

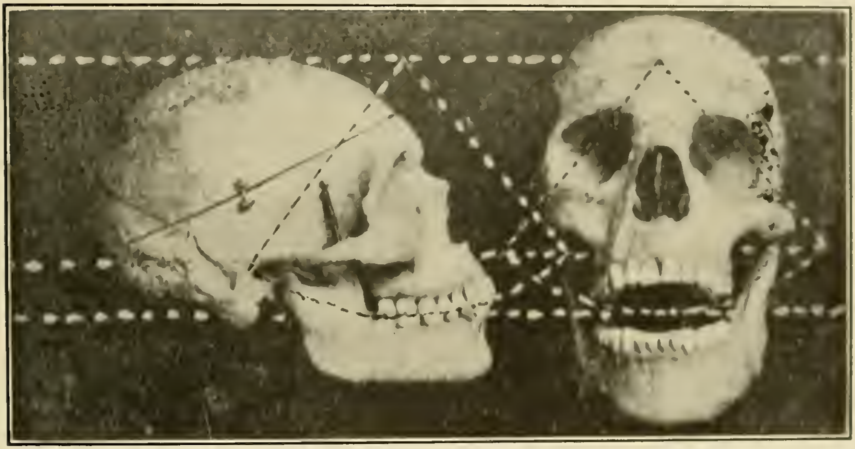

FIG. 12.

Fig. 12.—The same skull, viewed from both buccal and anterior. The lines show that the buccal and lateral compensating curves correspond.—(Prothero in *Dental Review.*)

Taking into consideration the occlusal surfaces of the teeth, it will be found in the ideal antagonization of the teeth that the cusps, fossæ and grooves correspond and move upon and into one another with a precision that closely approaches mathematical exactness. When the mandible is moved to the left side, the buccal row of cusps of the lower teeth on the right move upon the lingual row of cusps of the uppers with uniform and undisturbed contact, while on the left side both buccal and lingual rows come into contact with their antagonists with the same nicety. When the mandible is moved to the right, the buccal row of cusps of the lower teeth glide upon the lingual row of cusps of the upper, while both the buccal and lingual rows abut those of the opposite jaw. The anterior teeth will overlap so that their incisive edges will just clear.

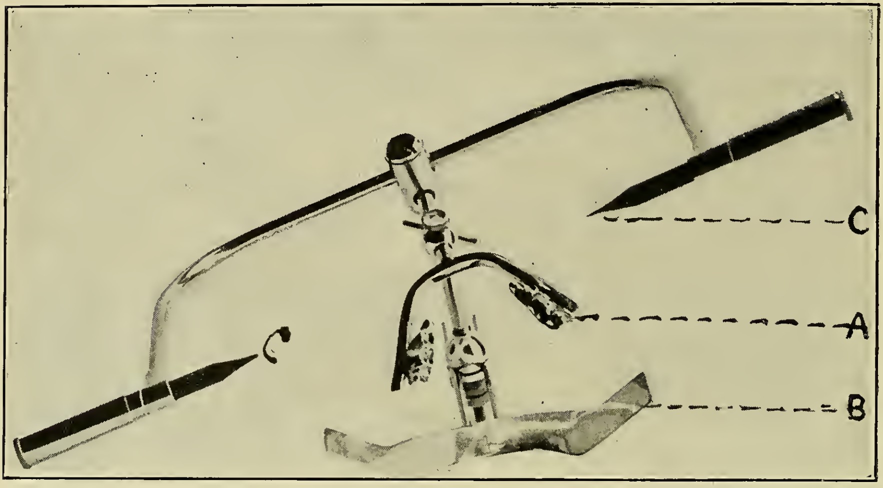

FIG. 13.

Fig. 13.—An instrument made to record diagrammatically the movement of the condyles. It is an elaboration of the Snow face bow, (a) is passed into the mouth and placed on the lower teeth. (b) Rests beneath the chin and, when clamped, fastens immovably to the teeth. The pencil points (cc) are adjusted over the condyles and will follow absolutely their course as the mandible is moved.

There will be neither a dragging of the cusps nor a perceptible space between them. The extent to which the anterior teeth may overlap is determined both by the pitch of the condyle-path and the depth of the cusps of the bicuspids. With a decided descent of the path and deep cusps to the bicuspids there can still be comparatively little overlap, unless there is considerable overbite.

The movements of the condyle upon the *eminentia articularis* can be recorded diagrammatically by means of an instrument capable of firm attachment to the mandible, and having an arm which will carry a pencil so that the point will touch the cheek directly over the center of the condyle (Fig. 13). This is an elaboration of the Snow Face Bow, and proves the correctness of the variance in the pitch, curvature and asymmetry of the condyle-paths. The point will follow exactly the movement of the condyle (Fig. 14). Usually the diagrams thus obtained are more or less curved, the concavity facing upward (Figs. 15 and 16). The amount of both curvature and inclination varies in different subjects, and frequently on the two sides of the same subject (Fig. 17).

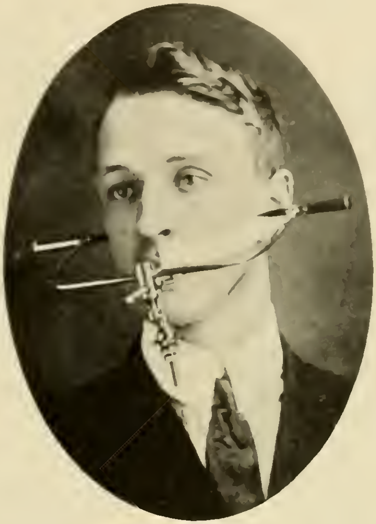

FIG. 14.

Fig. 14.—The instrument shown in Fig. 9, adjusted to the face.

Walker has pointed out some fourteen years ago that the average angle of descent of the condyle-path is 35 degrees, and that it varies from the horizontal to 50 degrees. As an instance of asymmetry of the paths he mentions two cases, one in which its angle with the occlusal line was 1 degree on the one side and 10 degrees on the other, and one with 22 degrees on one side and 44 degrees on the other (*Dental Cosmos*, 1896, January and July).

From the foregoing study it will be understood:

First.—That the contact existing between the teeth of the upper and lower jaws is governed by the temporo-mandibular articulation.

Second.—That a general knowledge of this joint is necessary to the comprehension of the fundamental principles underlying the antagonization of the teeth.

Third.—That in no two individuals is the joint formation identical; and that in many cases there is a considerable variance in the two sides of the same individual.

Fourth.—That a study of its formation and varied movements in the living subject would require too much time for each case in every-day practice.

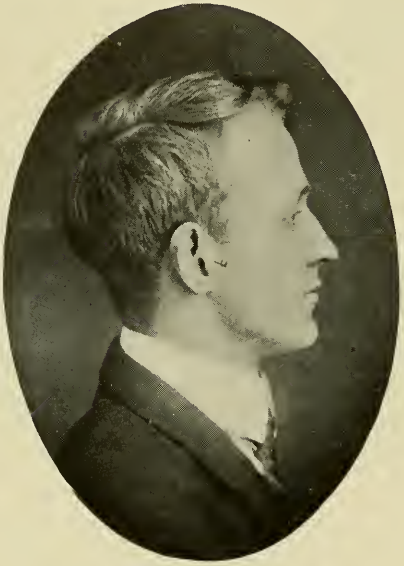

FIG. 15.

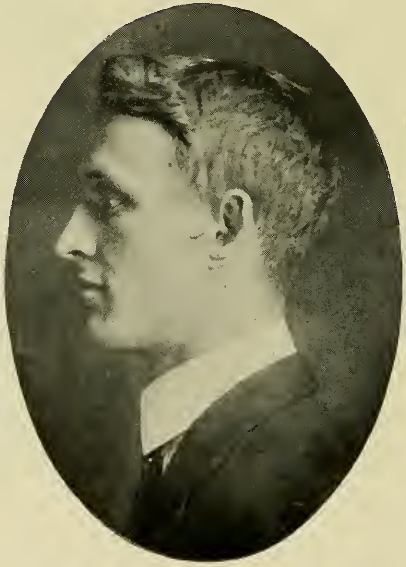

FIG. 16.

Fig. 15.—Resulting diagram of the condyle-path marked on the face, right side.

Fig. 16.—Resulting diagram of the condyle-path, marked on the face, left side. Note that they vary slightly in curvature and inclination.

It will thus be seen that, to be practical, the study must be readily made outside the body, and that any given case will possess individual characteristics of practical importance. As these facts became gradually recognized they compelled the production of mechanical devices by which the relations which exist between the occlusal planes of the maxillæ and the condyle-paths might be reproduced, and the various movements imitated with sufficient accuracy for practical application.

This, it seems, had a more urgent practical bearing in the construction of artificial dentures and evidently stimulated the prosthodontist to endeavor in this field, as it is to him that the profession owes the debt of gratitude for its invention. But while these principles have so far been confined to the construction of artificial dentures, the cycle of its application is now complete in that its worth will be recognized in orthodontia, which branch of dental science should be practiced only on the young. Therefore, the breadth claimed for the application of these principles earlier in the paper is surely based on logic.

A very brief reference to its evolution will be of interest and serve to give a better idea of the efficiency of the present apparatus.

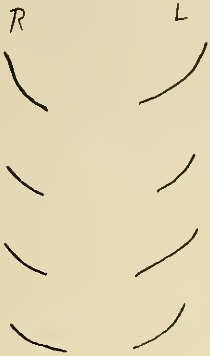

FIG. 17.

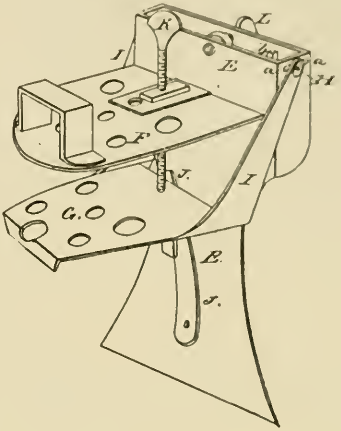

FIG. 18.

Fig. 17.—The diagrams of four condyle-paths. Note the variance on the two sides.—(Snow.)

Fig. 18.—First known effort to construct an anatomic articulator. The patent was granted to David T. Evans, of Philadelphia, in 1840. It shows at (a) the slotted joint for imitating the lateral and protrusive movements.

History of Anatomical Articulators.

The first recorded effort was made some sixty-nine years ago by David T. Evans, of Philadelphia. In 1840 he patented an articulator in which the joints were slotted, for the purpose of imitating the lateral and protrusive movements of the mandible. The slot representing the condyle-path is deficient in that it is horizontal (Fig. 18).

W. G. A. Bonwill (Fig. 19), also of Philadelphia, in 1858 gave the profession his articulator, with which all are familiar. This instrument is faulty in two important principles: (*a*) the condyle-paths are parallel with the occlusal plane; (*b*) it will not permit of adjustment to the

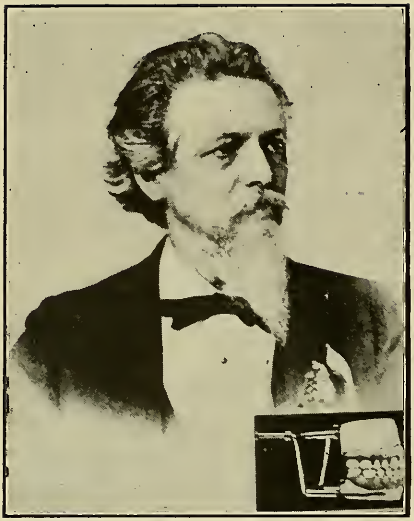

Fig. 19.

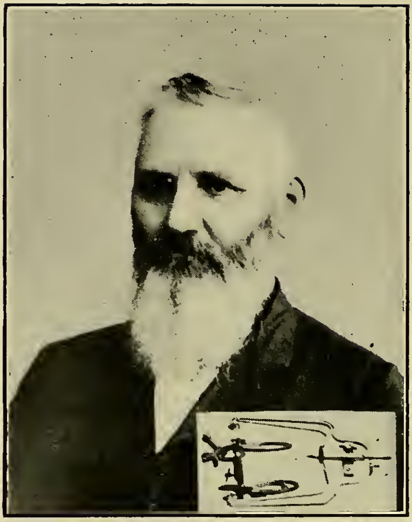

Fig. 20.

Fig. 19.—Dr. W. G. A. Bonwill and the articulator of his design supporting a set of teeth, ground by him after the principles he propounded.

Fig. 20.—Dr. Richmond O. Hayes, East Bloomfield, N. Y., was the first to recognize the descent of the condyle and the necessity of placing the models at the proper distance from the joint. He devised an articulator with fixed descending paths and a "facial caliper" for the purpose.

individual case, as the paths are fixed. The principles which he propounded concerning tooth articulation are extremely valuable, and have had a far-reaching effect, not only for their practical value, but for the stimulus given to others to investigate along this line. He did not appreciate the importance of the face bow and stolidly repudiated its worth.

Richmond S. Hayes (Fig. 20), of East Bloomfield, N. Y., about 1887 was the first to recognize the *inclined* movement of the condyle, and the importance of placing the models in the articulator at the proper distance from the joints (Fig. 21). He designed an articulator with fixed descending paths. He also invented an "articulating caliper," the arms of which were placed over the condyles, and by means of a movable joint he obtained the distance, it measuring this one relationship only. The two instruments were designed for combined use and were a great advance. Although he used these with success, he failed in his efforts to have them placed before the profession.

W. E. Walker (Fig. 22), of New Orleans, a member of your society, made known, in 1896, the results of his exhaustive scientific study of condyle movement, and advanced principles that were new and conclusive. He also invented what he chose to call a "dental facial clinometer," for registering the condyle movement, and an articulator which was an improvement on the Bonwill, in that the inclination of the condyle-path could be varied and established independently on either side (Fig. 23). The apparatus, while quite accurate, was so complicated that it did not come into general use. It was deficient in that it did not establish the relations of the occlusal plane to the joints.

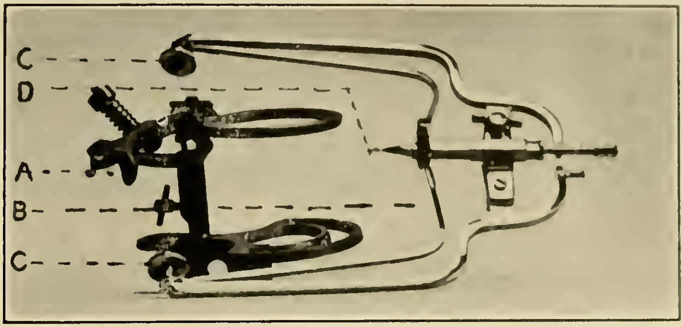

FIG. 21.

Fig. 21.—The Hayes apparatus (a) shows the fixed descending condyle-path; (b) the articulating caliper. The parts (cc) are placed over the condyles; (d) is an adjustable bar the point of which is pressed into the wax rim of the upper trial-plate while in the mouth and the caliper tightened. This will show the exact distance of the front of the models from the joint when adjusted to the articulator.

Prof. Carl Christensen (Fig. 24), of Copenhagen, about 1901, made a substantial advance, in that he brought out a simple, practical method of ascertaining the inclination of the condyle-paths.

There had, so far, not been a recognition of the importance of establishing the exact relations between the alveolar ridges and the condyles as they exist in the individual case. Dr. Geo. B. Snow (Fig. 25), Professor of Prosthetic Dentistry, University of Buffalo, in 1899 pointed out to the profession this previously unrecognized essential. For the purpose of establishing these relations, he devised the simple and efficient "face bow." This was the most important advance so far made, as no articulator, no matter what its perfection in simulating the movements of the temporomandibular articulation, could give correct results with

FIG. 22.

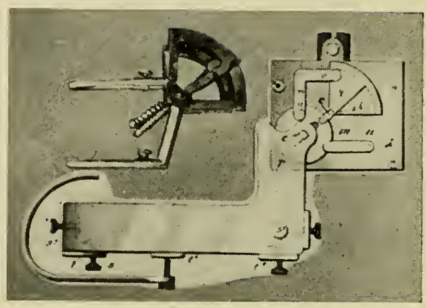

FIG. 23.

Fig. 22.—Dr. W. E. Walker, who invented the "dental facial clinometer" for measuring condyle movement. He also designed the first articulator with adjustable condyle-paths.

Fig. 23.—Dr. Walker's appliances.

out a means by which the anatomic relations of alveolar ridges and condyle might be transferred to it. It has been used with the articulator devised by A. DeWitt Gritman, who was then teaching in the University of Buffalo. This has fixed descending condyle-paths, the pitch having been determined by an average of the measurements of some fifty faces. In 1907 Dr. Snow brought out the New Century Articulator, which differs from the Gritman in having adjustable joint-slides for imitating the condyle movements peculiar to the individual case (Fig. 26).

By the use of the "face bow" in conjunction with the New Century Articulator, models may be set so that the anatomic peculiarities of the temporo-mandibular articulation and the relations of the occlusal planes to the joint are established with sufficient accuracy for all practical purposes. To obviate the necessity of defacing orthodontia models by attaching with plaster, the writer suggested a special support, into which models may be fastened with pointed screws (Fig. 27). While these satisfactorily hold the models, some suggestion for its improvement may soon be made.

The necessary apparatus will be the "face bow" with special mouthpiece, and the New Century Articulator with the special model supports.

Use of Articulator in Orthodontia Treatment.

The technique will be divided into three stages. (1) Making of models. (2) Determining the correct position of the models to the joint. For this the "face bow" is used. (3) Registering the pitch of the condyle-path.

Each stage will now be explained in detail.

(1) The models are made by the means in favor with the individual operator.

FIG. 24.

Fig. 24.—Prof. Carl Christensen, Copenhagen, who thought out a simple and accurate means of measuring the descent of the condyle. He also devised an articulator with adjustable paths similar to that of Walker.

(2) The corect position of the teeth to the joint is determined by the use of the "face bow." The special mouth-piece used for mouths containing the natural teeth is now filled with warmed wax, a small roll of which may also be placed at the anterior of the under side of the tray. This prevents slipping of the lower teeth. This is placed in the mouth so that the projecting stem is in the median line, and the patient is instructed to close. The wax is chilled and the whole removed and laid aside for a few moments. Going to the face, the position of each of the condyles should now be determined and marked upon the cheeks. The movement of the condyle is easily felt when the mouth is opened and closed. The marks are made over the condyles when the teeth are in occlusion, and are usually about fifteen millimeters in front of the external

Fig. 25.

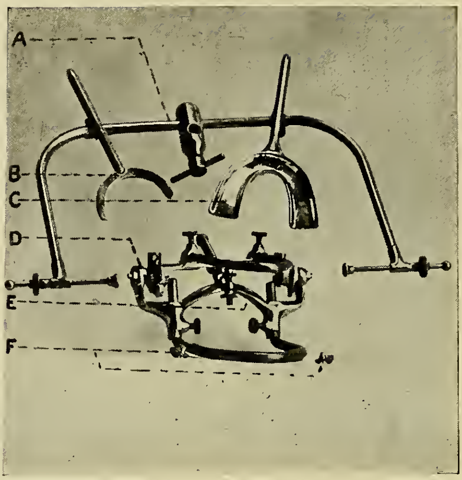

Fig. 26.

Fig. 25.—Dr. George B. Snow and the apparatus of his invention.

Fig. 26.—The Snow apparatus complete to date. (a) The face bow; (b) the mouth-piece for edentulous mouths; (c) the mouth-piece for use when the natural teeth remain, as used for diagnosis in orthodontia; for making interdental splints, etc.; (e) the New Century Articulator with adjustable condyle-path; (d, f), the bite gauges for registering the pitch of the condyle-path.

auditory meatus, and on a level with its floor. The "face bow" will next be adjusted to the width of the face. The condyle ends of the sliding rods are placed over the marks on the face, so that the two sides of the "face bow" are equidistant from the cheeks, and the rods then fastened. The scores on the rods will facilitate centering. The special mouth-piece is now returned to the mouth. The stem of the mouth-piece will project from between the lips. Slip the clamp of the bow over the stem, place the condyle knobs over the marks on the face and tighten the bow clamp securely. Withdraw from the mouth without disturbing the adjustment of the "face bow" (Fig. 28). This is now transferred to the articulator. Push the sliding rods inward as far as they will go, and tighten the controlling clamp-nuts. The sockets in the condyle-knobs will now spring over the condyle-spurs on the articulator joints. Fasten the plaster model of the upper into the bite in the mouth-piece, have the stem of the "face bow" so that it is horizontal, and fasten the model into the articulator by means of the pointed screws. The correct position of the upper model to the joint has thus been established. Now occlude the lower model with the upper and also fasten (Fig. 27).

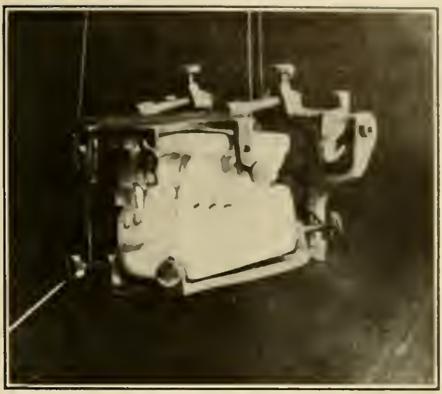

Fig. 27.

Fig. 27.—The New Century Articulator carrying plaster models in special supports to obviate the necessity of attaching with plaster. These are suggested especially for the orthodontist.

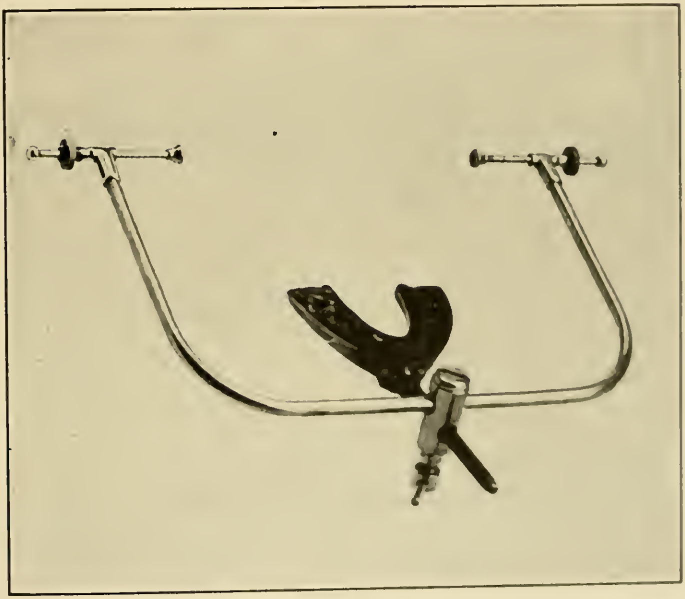

Fig. 28.

Fig. 28.—Face bow removed from the mouth containing the natural teeth with the bite taken.

The pitch of the condyle-path is registered in mouths containing the natural teeth by means of the old-fashioned "squash" bite. The patient is instructed to project the mandible for from three to five millimeters and close into the wax until the teeth meet anteriorly. The posterior teeth will not contact (Fig. 29). The thickness of wax between their occlusal surfaces registers the angle of descent of the condyle-path. The wax is well chilled, removed and laid aside for a minute until the articulator is prepared for reproduction of the pitch of the condyle-path. The spring is unhooked, and the gripping-screws of the joint-slides loosened. The "squash" bite is placed in position on the models, which are pressed firmly to place. This automatically moves the articulator condyle-paths into correct pitch. By tightening the gripping-screws this angle is maintained. The spring is hooked and the case is ready for study (Fig. 32).

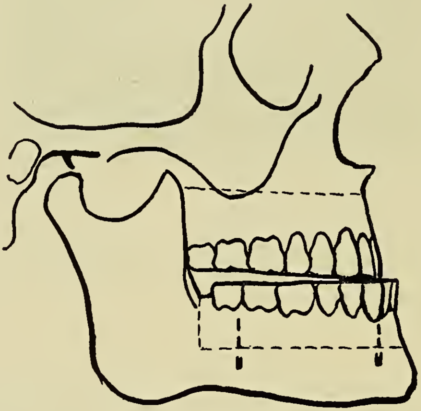

FIG. 29.

Fig. 29—Showing mandible extended. The amount of opening between the molar teeth is determined by the pitch of the condyle-path. The more marked the descent the greater the opening (see Fig. 31c). If the path were horizontal there could be no opening (see Fig. 31b).

The *natural* occlusion may now be noted for diagnosis and classification. By oscillating the articulator, peculiarities of tooth contact may be observed as by no other means. The appliances should be planned with the one object of carrying the teeth to such position that normal jaw movement may be carried out with *uniform and undisturbed contact.*

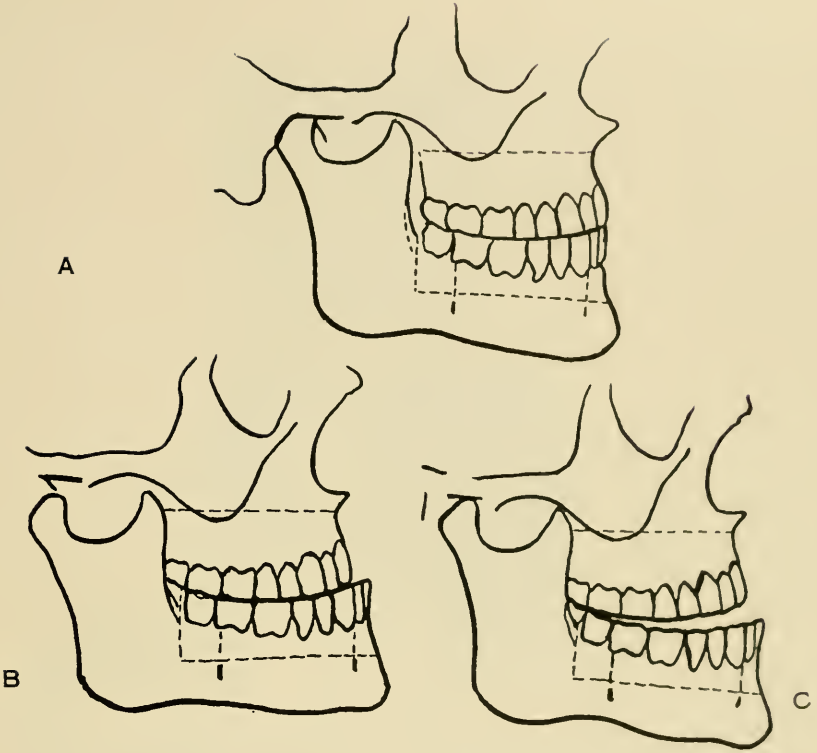

FIG. 30.

Fig. 30—Showing chart having two condyle-paths, the one descending, the other horizontal; (a) represents the mandible at rest, (b) the mandible protruded with the condyle following the descending path. The buccal compensating curve—curve of "Spee"—is in harmony with the angle of descent of the path; therefore, the teeth contact in the bicuspid and molar regions. (c) The mandible protruded with the condyle following the horizontal path, showing the resulting opening in the incisor region.

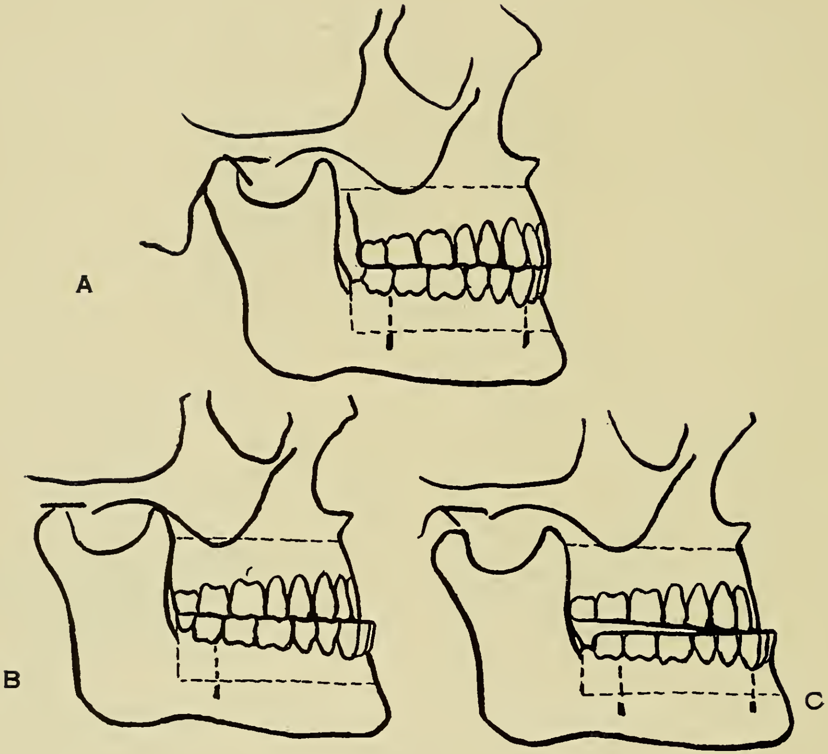

FIG. 31.

Fig. 31—Showing same chart as in Fig. 30, except that the teeth are arranged with no curve. (a) Representing the mandible at rest, (b) the mandible protruded with the condyle following the horizontal path. The teeth are seen to contact in the molar and bicuspid regions, (c) the mendible protruded with the condyle following the descending path, showing the resulting opening in the molar region.

When this is accomplished the writer knows that harmony will result, and it is his belief that many of the discouraging failures in retention will be obviated and results will be obtained which few have recognized and still fewer have experienced.

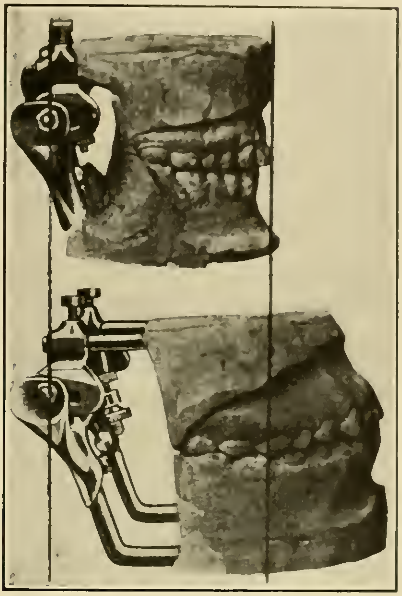

Fig. 32.

Fig. 32.—Two cases mounted with Snow face bow. These will serve to show variance in distance from the joint. Note that the upper central incisors in the one above are on a line with the distobuccal cusp of the upper first molar in the case below.

Discussion of Dr. Waugh's Paper.

Dr. S. Merrell Weeks, Philadelphia.

The value of the paper to which we have just listened is, I believe, very great. The influence of that paper will be much greater than we shall appreciate until we have made a much more careful study of it than the time at our disposal has enabled us to do. It is of particular interest to me, because you will remember that for several years—in fact, almost the entire time I have been engaged in the practice of orthodontia—I have been much interested in the relation between the temporomandibular articulation, and the antagonization of the teeth. Much has been done in the past four or five years to enlighten us in this line. The paper we have just listened to will do much to lessen the obscurity with reference to these relations.

The essayist, in summing up, says the contact between the upper and lower teeth is governed by the temporomandibular articulation. This does not coincide entirely with my interpretation of those conditions. I have stated, and I believe, that the occlusion of the teeth—their antagonization—the different conditions brought about by mouth-breathing, the abnormal conditions, habits of thumb-sucking, etc., are factors in forming or determining the formation of the glenoid fossa. The essayist says that the glenoid fossa is a mere depression. I would take exception to that. It is, perhaps, at one time a mere depression in early life. The slight depth of this depression in early life allows the condyle to rest in the glenoid fossa in one of many different places; the occlusion of the teeth, habits, etc., may influence those positions, but as the forma·

tion of the glenoid fossa proceeds during the life history, that formation is dependent on these principles; the occlusion of the teeth, if it be of one character, will cause the formation of the joint in one way, and if of another character, in another way. The growth of the joint is along the line of the least resistance: growth of bone takes place more rapidly—as is proven by the character of the bone—where the pressure is the least. Where the condyle rests longest, therefore, we would have the least development and, therefore, the deepest portion of the glenoid fossa. It is with reference to those cases where the joint has been formed gradually and definitely, as influencing the retention of the teeth where they have been moved by orthodontic procedures in a comparatively short time, that I principally wish to ask your attention. While I am confident that the several conditions which I have mentioned are responsible for the formation of the glenoid fossa during the early years of the child, I also believe that many cases of retention failures could be traced to the adverse influence of the temporomandibular articulation after it has reached its full development. Were we sufficiently familiar with the relation of action existing between this joint and the occlusion of the teeth, I am sure that a careful study and application of the principles set forth by the essayist will help us to avoid many of these pitfalls.

I wish to express my appreciation to Dr. Waugh for the work he has done and the foundation he has given us to work on, but I feel that I can not discuss the subject satisfactorily until I have time to try in practice the principles he has advanced.

Dr. Ernest Walker, New Orleans.

I think we have just listened to a very scholarly paper, one well worthy of study by all of us. There is much of value in it, and, at the same time, there are a few errors I believe. For instance, it was stated, or illustrated at least, if not stated, that the compensating curve of Spee does exist, and it was demonstrated with artificial teeth. That, perhaps, left the impression that in the natural teeth the compensating curve of Spee would be operative, which is not the case. In artificial dentures it is important to provide for the compensating curve of Spee and to have the molars touch at the same time as the incisors do. Bonwill laid stress on the balancing, although the curve was not given by him because the condyle-path was horizontal in his articulator. Even in prosthodontia the perfect balance that may be produced is not of just the same importance in the mouth as it would appear to be when operating out of the mouth, for the reason that in the case of the artificial teeth we are not engaged in moving the teeth about with nothing between them, and when a bolus of food is put between the incisors, even though we have the curve of Spee, the balancing is at once lost till the bolus is cut through; it being inoperative at the very time it is most needed. Until the contact you will not get the balancing in the molars; still the curve should be given. The same thing applies to the lateral compensating curve. A bolus of food would destroy the balancing on the opposite side. The presentation did not quite give the correct impression, in that the illustration would make us believe that we have the balancing occlusion in the natural teeth on one side to balance the teeth and function on the other: that the buccal of the lower would come in contact with the lingual of the upper on the opposite side from that on which they function. This is an error. You will not find the forward or lateral balance in one per cent. of the natural cases, although it is important to produce it in the case of artificial teeth. In the nineties I read a paper before the American Medical Association touching upon this subject. I believe that a full study of the matter would lead to much benefit in the treatment of the pathology of the pericementum, as well as in orthodontia. I still believe that to be true, but my innermost feeling on the subject is not so enthusiastic as it was at that time, because, as I say, these balancings do not occur in the mouth and because Dr. Weeks is right in stating that it is not a fact that the shape of the path of the condyle decides the position of the teeth primarily. The bones, hard as they are, and which would not easily be penetrated with nerves and arteries, are, nevertheless, penetrated, for the reason that the bones come last; the arteries and nerves were there first and the bones were formed around them. The final growth of the bone comes at a later date than the muscle, too, the bone and the joints are shaped and influenced by the functions they are put to. It applies likewise to the articulation under consideration.

We have in the deciduous denture very little of this compensating curve and very little descent of the condyle; the glenoid fossa is almost horizontal, but it is not to say that it is that way because of the deciduous teeth. The deciduous teeth take their shape before they emerge from the bone, and the fossa is adapted to the function required of it. For it to be so that the condyle's path influences the formation of the teeth you would be obliged to have these influences operating when the primitive cusps were being formed. When the teeth come down then the length of the cusps influences the function which shapes the glenoid fossa. That is, speaking primarily. Secondarily, however, if we straighten a set in which the fossa is already formed and in which there are enough teeth left in harmony with the shape of the condyles and glenoid fossa for the function to be continued as established, should we leave one or two teeth out of harmony the one or two teeth will have to give way. Therefore, the path of the condyle, although influenced by the sum total of the teeth, will change the position of one or two teeth which are out of harmony. This is a matter of great practical importance to us as orthodontists. We must, without underrating the importance of occlusion, give more attention, I believe, to articulation; to the position of teeth in function than some of us have done. In that connection I would like to exhibit a new form of cast. I say new because it has not been before this Society. I designed it in 1907 in New Orleans, and have shown it to other societies. With the old form of backward extension we could not view the casts from the back, while here we can see the teeth from the lingual aspect. [Models exhibited.] In treating a case I take bites from time to time in modeling compound to study the occlusion from the lingual, as well as the buccal, aspect, and can thus the better watch the progress of treatment. The final articulation can be gotten in the mouth itself in orthodontia. Bear in mind the fact which I have stated, that the lingual cusps are of importance in occlusion, but in articulation they are very seldom in function. If you put the buccal cusps together on one side you find the lingual are not touching, and no teeth are touching on the other side, but in occlusion you must consider every cusp. They separate in grinding because the buccal cusps of the lower are so much higher than the lingual, and the reverse with the uppers. In studying the grinding function in the mouth, after the occlusion itself is correct, the method of the prosthodontist of using a thin piece of carbon paper, often detects some point touching that should not touch.

A study of this subject of the position of antagonism in the functioning of the jaw emphasizes the importance of correcting each individual tooth in the bicuspid and molar region. A good many finished cases are illustrated in which the bicuspids and molars are not all properly arranged, and one reason why they get out of position later is because of their not being properly articulated.

Dr. Fiederspiel, Milwaukee.

About two years ago, before the Wisconsin State Dental Society, I read a paper on mouth-breathing, its influence on the dental arches and jaws, and demonstrated how the physiological development of the mandible and glenoid fossa can be altered by the inequality of muscular action due to nasal stenosis. Since that time I have made quite a number of dissections of infant cadavers and I was surprised to find that the glenoid fossa was comparatively shallow and undeveloped. I have been following this matter up very closely, and I hope at a later period to demonstrate that a knowledge of the development of the glenoid fossa would play an important part in the correction of mouth deformities.

In this connection I will show on the screen the profile of a patient suffering from Class II, Division 1 (Fig. 1). The patient is fifteen years of age and has a history of nasal stenosis, hypertrophy of turbinate bones, adenoids and enlarged tonsils. The patient was anemic and poorly developed. In correcting this case I obtained a normal relation of the upper and lower teeth when the mandible was voluntarily brought forward, and thereby obtained great improvement in the facial lines, as illustrated in the next picture (Fig. 2). But I found it almost impossible to retain the teeth in that position because the glenoid fossa had developed in an abnormal position due to inequality of muscular action, and for that reason the mandible had a tendency to drift distally because it was impossible for the condyles to rest on the eminentia articularis.

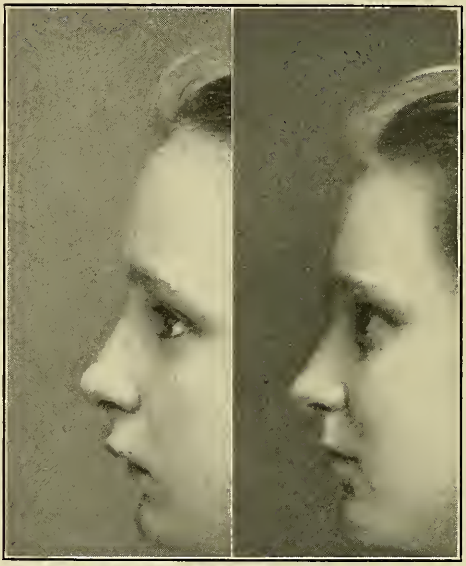

FIG. 1. FIG. 2.

For that reason, I am confident that when I attempt to correct Class II abnormalities, after the alveolar processes and jaws had developed and after the muscles become stronger and more set, that the treatment, notwithstanding the use of modern retainers, would in most cases prove futile. I have come to believe that if these cases of abnormalities were treated during the time when the dental areas were developing that it would be an easier matter to permanently correct the deformities.

Dr. Ottolengui. I have had very great pleasure in hearing this paper, because, just as I said when I heard Dr. Hawley's paper at St. Louis, I thought, it marked the beginning of a new era of treatment by enabling us to determine the occlusal or normal curve of the arch, so I believe we are now beginning seriously to seek for a means of determining the normal occlusal planes of the teeth, and with that knowledge we will later on find a way of establishing those planes. It has also been my feeling, as most of you know, that in those special cases of Class II, in which some of my friends believe there is a supra-occlusion of the lower incisors, there is not really a supra-occlusion of the lower incisors, but the patient is suffering from a lack of vertical development of the molars and bicuspids.

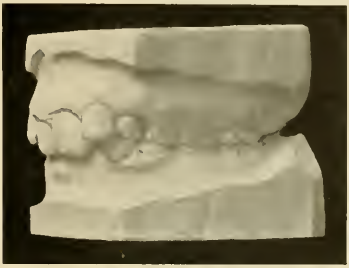

FIG. 3.

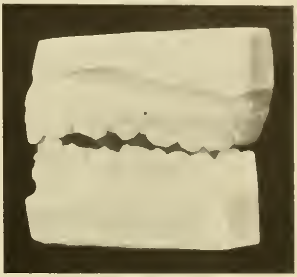

FIG. 4.

I will consider the matter of Dr. Waugh's paper for a moment as I understand it, and as the first two gentlemen discussed it, Drs. Walker and Weeks. I agree with what they said, but I do not think Dr. Waugh said the path of the condyle controls the occlusal plane of the teeth, but that it registers it. That is a very great difference. I believe the truth is that they are independent, and that they are developed to meet the requirements of the individual. If, for any reason, there is a lack of vertical development of the molars and bicuspids, the lower arch and mandible will remain in an abnormal position, and the glenoid fossa will form around the head of the condyle, and if untreated that relation may be permanently established. In treatment, so far as the mandible is concerned, you will either be compelled to rearrange the occlusion by moving the lower teeth forward through the process, leaving the chin where it is, and leaving the glenoid fossa unaltered, or else you must rearrange the glenoid fossa by resorption. While Dr. Cryer proved such resoption to be a possibility, we have no knowledge to prove that his case did not require some forty years or longer in its accomplishment, and that is rather long for orthodontic treatment. Therefore, if we really wish to properly treat these Class II cases we should get them as early as possible, and we should realize that we are not simply to work for a proper arrangement of the teeth, but that we shall retain that arrangement and position of the mandible until permanency shall be atained by the formation of the glenoid fossa over that condyle in the position in which you want the mandible to be maintained.

I think these articulators may be of immense benefit to us in this way; if we can make study casts in the beginning and establish the true relation on these articulators, taking it for granted that they are accurate, and so get the condyle-path we will register at the moment the condyle-path which agrees with the teeth as they are, and this will also indicate to us, I think, too great an open bite in the molar region when the incisors are in contact. That will show us how much to elevate the molars and bicuspids of the lower jaw. If we can elevate them sufficiently we will also, by establishing the normal plane, prevent a distal return of that mandible, and to that extent help in the formation of a glenoid fossa, which will retain the mandible in the position desired.

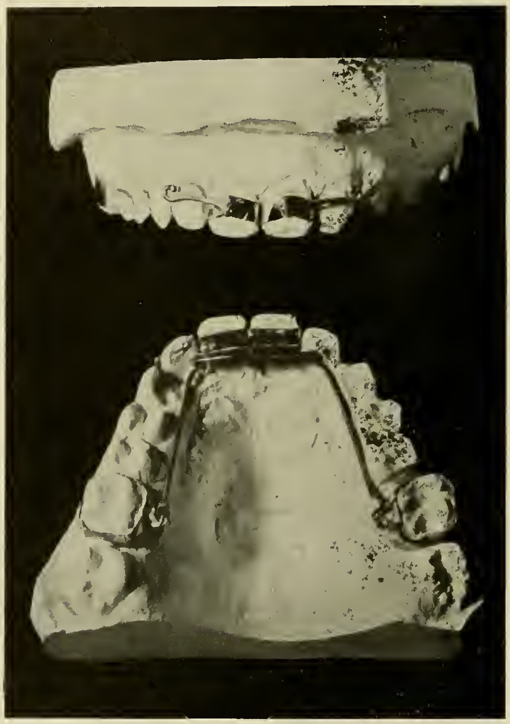

Fig. 5.

Dr. Alfred P. Rogers, Boston.

Fortunately I have with me models illustrating infra-occlusion of the lateral halves. Fig. 3, is a case where it was necessary to rearrange the whole occlusal plane.

Fig. 4 illustrates the condition of the bite after the application of the apparatus and before the vertical development had taken place.

Fig. 5 illustrates an apparatus worn on the upper arch, by means of which the infra-occlusion was corrected.

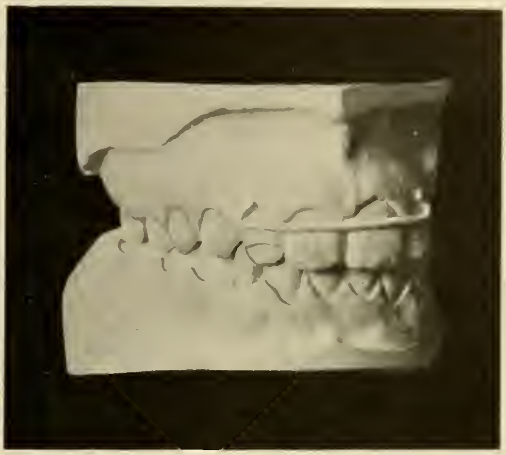

FIG. 6.

Fig. 6 illustrates the same model after the molars and bicuspids had almost come into occlusion. The molars were brought into their occlusal relation by means of small intermaxillary elastics applied to hooks, soldered to bands on each molar. I think this illustrates the principle under discussion to-day.

With the removal of this apparatus I find that the patient has no tendency to bite back into the old position.

I once saw a case in Dr. Ottolengui's office. It was a pleasure to me to note that the child could not bite back into the old position without great discomfort, which seems to show that a change in the glenoid fossa must certainly have taken place.

Dr. Waugh.

In listening to the discussion of Drs. Weeks and Walker I could not make up my mind as to whether they tried to emphasize the points I brought out, or were trying to contradict them. If Dr. Weeks intended to refute anything I said I most assuredly feel he failed to do so

We talk of the change of the condyle-path with advancing years. Here is a picture from "Turner's Prosthetic Dentistry" that I chanced to bring. It is a case of the "Lymphatic Temperament." We see a compensating curve there. The teeth are worn down, the cusps being obliterated (Fig. 7).

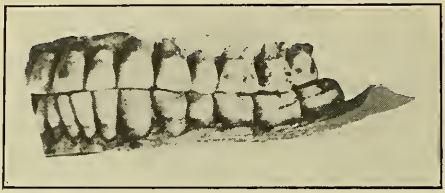

Fig. 7.

For every-day work we must have apparatus which will reproduce with sufficient accuracy the anatomical relations of the alveolar ridges to the joint and the pitch of the condyle-path for practical purposes. We can not reproduce it absolutely; that would require too much time.

The discussion of the gentlemen who criticised and commented on the shape of the glenoid cavity and its influence in controlling the movements of the mandible, considered those parts as we see them in the museums in the dried specimens. We want to reproduce these relations as they are in the living subject. In Fig. 8 we have the head of the condyle in the glenoid cavity. It is just bone.

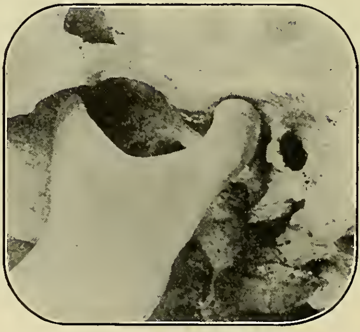

Fig. 8.

In Fig. 9 we have the living specimen, and the condyle does not fit closely to the cavity. Note the relation of the head of the condyle to the temporal bone. The inarticular cartilage with the two synovial sacs interred. Dr. Walker said that in prosthodontia we want a balancing contact, yet we do not need that with the natural teeth. I said in the paper that normal occlusion is an ideal. I do not mean to detract in anything I say from the value of normal occlusion. In how many skulls of the thousands examined have the comparative anatomists found normal occlusion? It is, however, the ideal toward which we should work. Because Dr. Walker is not quite so enthusiastic to-day about the value of this as he was in 1890 should not militate against our taking it up and studying it. He knows so much about it from his original studies that to him it may seem common, but he should not discourage us in the development study and development of this most practical consideration. There is surely an opportunity by following this up to make our work easier and more efficient.

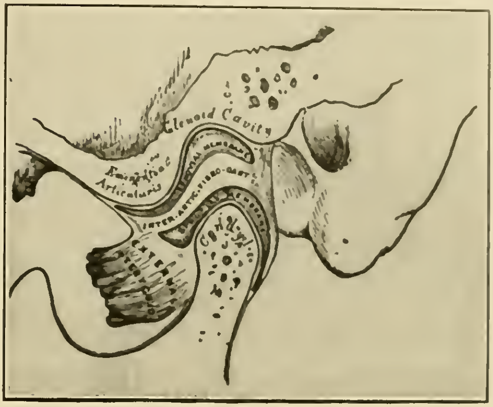

FIG. 9.

Dr. Walker. I omitted to speak of the face-bow in discussing Dr. Waugh's paper. I think that fills a long-felt want. Some of the measurements secured by it were such as could not be had by my method. I wanted to ask Dr. Waugh in closing if he could give us the date of publication of Dr. Hayes's work. We have all the other dates in his paper, with the exception of that one, and it would help us to be able to read Dr. Hayes's work.

Malocclusion from the Dentist's Standpoint.

By Dr. E. E. Hall, Columbus, Ohio.

Malocclusion, as studied by the specialist, is viewed from an entirely different standpoint from that from which the dentist looks at it.

Whereas, the specialist devotes his attention to the study of the diagnosis, classification and treatment, especially of the cases of youth, the average dentist, not having grasped the principles of diagnosis, is still looking through a glass darkly, as it were, at cases of malocclusion presenting, with the result that he misses malocclusion in the children's mouths, from a lack of knowledge of what to look for, and the cases which he treats ore usually those of adults.

The theory of non-extraction has arisen before the practice of extraction has been buried as it should be under the sod of error and false teaching.

Hence, the older dentists daily pass in review in the adult mouths the results of the extraction of first molars and other valuable teeth in the mouths of their earlier patients. Their chickens have come home to roost, as the saying goes, and to those that have had their eyes opened to their error in the treatment of malocclusion by extraction, the toothless spectre of their earlier mistakes haunts even their waking hours.

Now the progressive trend of dentistry has been along conservative lines, it is true, but it takes many years for the average dentist to gain the theory and practice of conservation of the dental organs which the present-day graduate starts out with when he leaves his Alma Mater.

Also, in manipulative skill, the average dentist is undoubtedly clever, and for years he has been patting himself on the back and posing as a member of a progressive profession, blissfully ignorant that the train of progress on which he supposed he was traveling had switched his coach on to the siding of "Lost Opportunity," which simply implies that he has been unable to keep up with all the advancements in dentistry, and especially with those in orthodontia.

The development, then, of the science of orthodontia has brought a new era to dentistry, in the knowledge of the value of the individual teeth of both deciduous and permanent sets, and the danger of the lack of their conservation. In other words, the greatest insurance for the preservation of the teeth is the preservation of a normal occlusion.

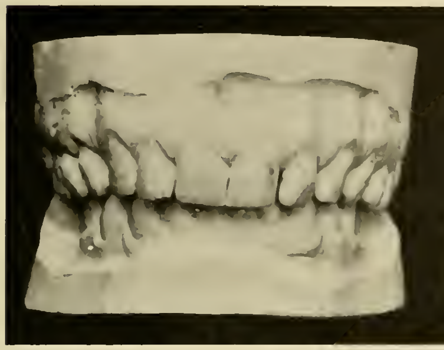

Fig. 1.

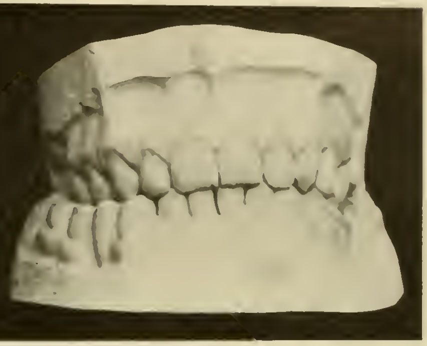

Fig. 2.

Also, this new era has shown the dependence of the dentist on the orthodontist and the wisdom of referring the cases of malocclusion to him.

If the dentist does his duty in these respects, the younger generation will not become the specters of his old age, grinning at him with reformed dental arches and distorted mouths, but, on the other hand, if he does his full duty by his patients as before mentioned, he may confidently expect to be ministered unto his dotage by such visions of beauty as surpass the imagination.

But to show you that the dentist has not yet been able to fully appreciate the benefits of this new era in dentistry, in which conservation of the dental organs is the watchword, let me present a few cases (which come from the other man's practice) that will support my arguments.

Fig. 1 illustrates a case of malocclusion which is somewhat typical of the loss of the lower first molars, exhibiting a deep overbite of the incisors from the early extraction of these teeth.

Fig. 2 shows the inharmony in the arches from the extraction of upper first molars and lower left first molar, resulting in a lingual occlusion of the upper arch on the right side and a crippled occlusion on the left side.

This patient as a child was assured by the dentist after he had extracted the first molars, that the second molars would in time move forward and entirely close the space.

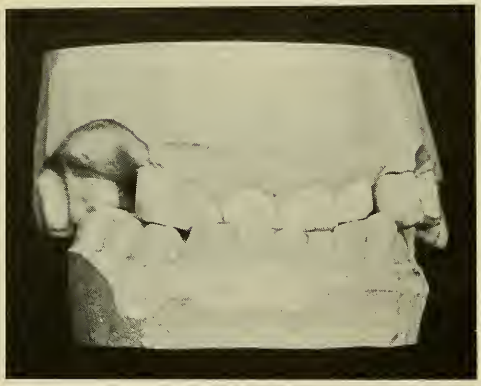

Fig. 3.

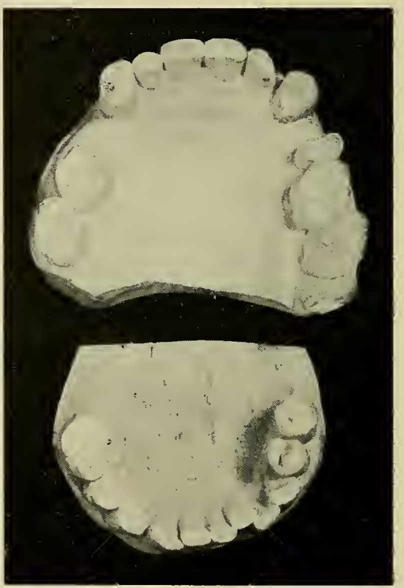

Fig. 4.

Fig. 3 is a malocclusion caused by the extraction of five lower molars, three upper bicuspids and one upper molar. In this case it will be noted that the incisors remaining had to do the service of the lost molars, and the bicuspids have been worn down so that their incisal edges have become broad grinding surfaces; Nature's only means of compensation.

The occlusal views of the upper and lower casts of this case in Fig. 4 show the broad facets upon the incisors more clearly, as well as the changes in the arches due to the extractions.

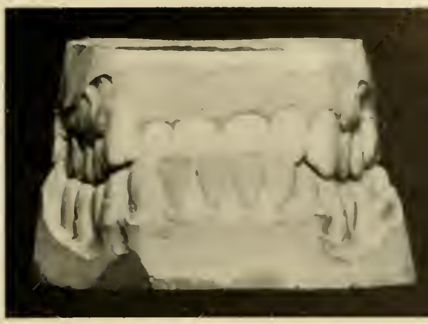

FIG. 5.

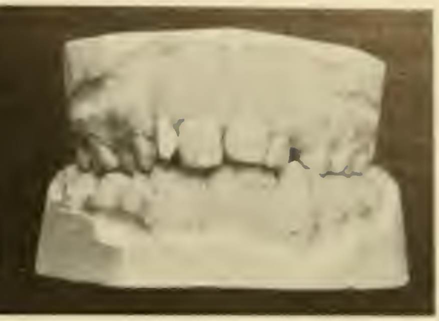

FIG. 6.

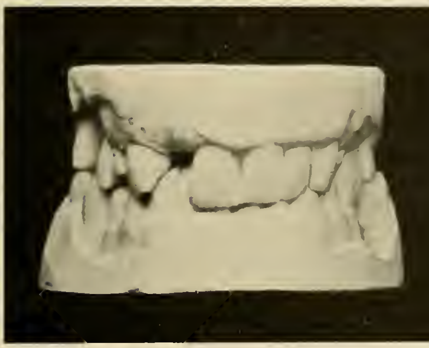

FIG. 7.

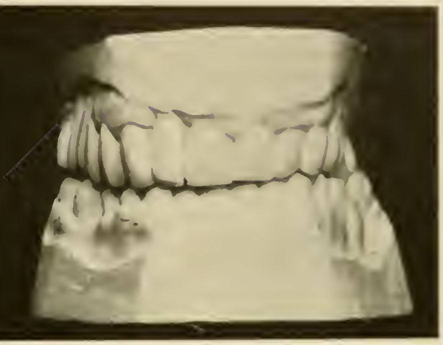

FIG. 8.

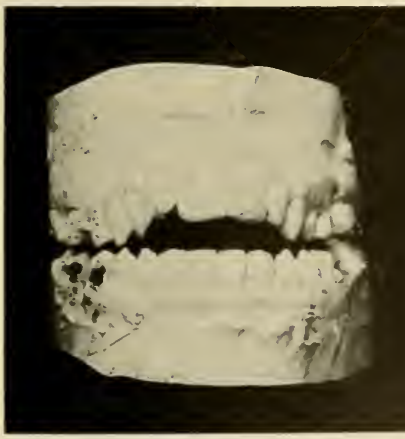

FIG. 9.

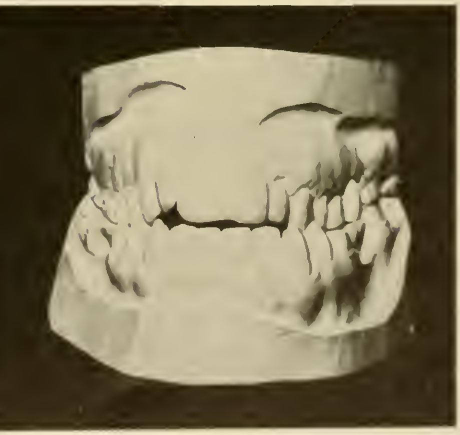

FIG. 10.

Fig. 5 illustrates a malocclusion, which three bridges and five porcelain crowns failed to remedy, wherein a previous visit to the orthodontists would have secured a nearer approach to the normal in occlusion in a mouth badly mutilated from extraction.

Fig. 6 exhibits the result in a case of extraction of cuspids for the purpose of "regulation." As it was a simple class I (Angle) case, the loss of these teeth under any circumstances would be inexcusable by the orthodontist.

Fig. 7 represents the occluded teeth of a patient who may really be said to have been suffering from a malocclusion. The lower incisors were biting into the upper gums, and pyorrhea was much in evidence. It is no wonder that he had a history of intestinal disorders, indigestion and pyorrhea after the loss of so many teeth and with such a malocclusion.

Fig. 8 represents the improvement in the conditions after bridgework and treatment of the pyorrhea, which resulted in improvement of the general health.

Fig. 9 exhibits an "open-bite" case in which the only two points of contact between upper and lower arches are the occluding cusps of the upper and lower second molars on each side. This case was treated by the removal of the pulps of the upper and lower second bicuspids and second molars, the teeth being shortened by grinding until occlusion of the anterior teeth was obtained. The result shown in Fig. 10 enabled the patient to chew his food and he gained twenty-six pounds in three months after the treatment. It will be seen, however, that the result is still a malocclusion. In proper sequence, this patient should have been referred to the rhinologist for removal of adenoids, to the orthodontist for correction of malocclusion at an early age, and then to the dentist for dental services, if needed.

In view of these serious malocclusions, some of them occuring largely as a result of needless extraction of teeth, it is evident that the education of the dentist along the lines of the orthodontist's work is necessary before the laity in general can be properly informed of the great benefits accruing from a correct diagnosis of malocclusion, and especially from early treatment of incipient malocclusions, as well as from an intelligent understanding of the relations between naso-pharyngeal troubles and deformed dental arches.

Therefore, it is my earnest hope that the American Society of Orthodontists will consider this question of the education of the dentist at least in the first principles of orthodontia.

Just how this may be done, I cannot say, but already through your society papers, and as a result of your treated cases being under the observation of the family dentist, much along the line of education in orthodontic principles has been disseminated.

In conclusion, I will say that when the dentist appreciates fully the idea of normal occlusion, the integral value of the individual teeth and the hindrances to the natural and normal development of the dental arches, then, indeed, will the era of dental conservation be seriously begun and the field of the specialist will be firmly established because of its distinct need and service to humanity.

Discussion of Dr. Hall's Paper.

Dr. Young.

Mr. President and Gentlemen:—I have been very much interested in this paper because of the fact that it has been presented by a man not a member of our Society, and one who is not devoting special attention to the correction of malocclusion. I think you will all agree with me that Dr. Hall has been paying attention to malocclusion, although he is not treating malocclusion as we do, but rather from the prosthetic standpoint. I think his paper can be taken as a very good proof that the rank and file of the dental profession are not as familiar with the occlusion of the teeth as they should be. If that were not the case Dr. Hall would not have such models to present to us as he has shown today. It seems a pity that educated people, and people with means, should be allowed to grow to adult age with their teeth in the condition of the man whom the Doctor said was a banker, and his father before him a banker. There was a man who certainly did not have any way of masticating his food. It all goes to prove that the majority of men in the dental profession are simply looking for cavities, and are stoppers of holes, as a rule. Dr. Hall is an exception, and he deserves a great deal of credit for calling his patients' attention to the necessity for doing something in these cases. There has been a feeling for many years that it is not advisable to insert a bridge for one tooth. I was criticised severely for advocating the removal of the enamel of a molar and bicuspid to supply a lost lower molar—not by the patient, but by the dental profession. They thought this tooth was not of sufficient consequence to warrant the grinding down of two comparatively sound teeth to put in such a bridge; but when you realize what happens to the remaining teeth, and how little occlusion the patient has in a few years on the side where the lower molar is missing, you must agree with Dr.

Hall that it is very advisable to do this very thing. At the present time, since the introduction of cast gold inlays, it is not necessary to put full caps on these teeth.

Very few general practitioners are advocating the insertion of a single molar tooth for their patients. They think they do the patient good service to let them go. I think they would soon abandon that idea if they would take accurate impressions, and make casts of these cases and study them from year to year, and thus find out what is occurring in such mouths.

The case of the open bite, or infra-occlusion in the anterior part of the mouth (Fig. 9), would seem to prove that there is sometimes an over-development in the bicuspid and molar region, because he showed conclusively by the second picture (Fig. 10) that he had shortened the molar teeth and brought the anterior teeth pretty close together.

Dr. Hall. They were together.

Dr. Young. You simply shortened the posterior teeth?

Dr. Hall. Yes.

Dr. Young. That proves that there may be a constant elongation of the molars and bicuspids, due to sleeping with the mouth open. I think that a point worthy of serious consideration.

Dr. Goode. I want to say just a word. The essayist has said one thing that might be used as a slogan by dentists. He said that in the preservation of the human teeth the first thing to be considered is normal occlusion, and the second, prophylaxis. That ought to be placed on the fence-posts and bill-boards all over the country, so that people could see it.

Dr. Fiederspiel. The open bite, I believe, is due to nasal stenosis, because it has a tendency to allow the mandible to develop into an obtuse angle. In examining a large number of cases of malocclusion, where the anterior teeth were found to be in infra-occlusion, the mandible usually had developed into the shape of an obtuse angle, and the patient, in each case, gave a history of some form of nasal stenosis. Dr. Case brought this out several years ago, and has illustrated it in his text-book.

The failure of the mandible to develop normally is usually due to gravity and inequality of muscular action. To correct this deformity in pronounced cases, it would be necessary to resort to surgical procedure.

Dr. Hawley. I think it is interesting for us to note the effect of a real study of occlusion upon a man who has been brought into that study through his work as Dr. Hall has, and it should be a source of gratification to consider in the light of what he has shown on the screen (cases which are familiar examples) of the conditions that we are really preventing. I felt, while listening to his paper and thinking of the models, that it was really a source of a great deal of gratification that there are some people, of the future generation at least, that would be in better condition than these.

I know that Dr. Hall has been very serious in his consideration of such problems, and has been striving to do the best he can for his people, but his pictures show really how far short are the ends which may be accomplished without the benefit of orthodontic treatment.

I was much interested in the whole subject, and would second what Dr. Young said about the restoration of single teeth. I have had a number of struggles with dentists in regard to that very question—the substitution of a single tooth in the mouth. I do not question that it is because those dentists have not studied the occlusion of the teeth, and do not realize the injury that the loss of a single tooth may do to the mouth.

I think we should be grateful to Dr. Hall that a member of the profession outside the ranks of the orthodontia specialists should show such an appreciation of the work of the American Society of Orthodontists.

Dr. Wm. C. Fisher.

I am a very good example of a man who is not an orthodontist, but who has come a long distance to learn what you gentlemen are doing, and why; also, what you would have the dentists do. I have taken, in recent years, a great interest in orthodontia, and to-day make models of a great number of my cases to see if they should be referred to the orthodontist. I have only done this within the past eighteen months. Before then I never had it impressed upon me what occlusion meant, and I think this interest was first stimulated by the reports of this Society as published in Items of Interest. I am following the work closely, not with any anticipation of ever becoming an orthodontist, but I feel I cannot give the proper services to my patients unless I do know more about it. I do not feel I know when a case should be referred to an orthodontist unless I make models and study the subject of occlusion.

Dr. Munroe.

Dr. Hall has given us a very instructive paper. I have been particularly interested along the line of malocclusion, and, being more of a general practitioner than an orthodontist, I am glad he has brought the attention of this Society to the fact that many dentists do not appreciate the occlusion of the teeth. I have often wished that this important matter could be more firmly impressed on the minds of the dentists, for I venture to think that a large majority—I hardly know what percentage—would scarcely know what occlusion means if asked what teeth occlude with one another. I have endeavored ever since I attended the Angle School to give especial attention to malocclusion and the proper alignment of the teeth, as well as to the substitution of needed teeth. I enjoyed the paper because it comes home to me and impresses me more indelibly, that I should advise my patients more and more along the lines of proper occlusion.

Dr. Hall. I am heartily in accord with Dr. Fisher in regard to making models of cases which come our way, because we get a clearer conception in that manner than it is possible to get from the mouth. If more dentists did this the good to be accomplished might be a great deal.

The percentage of dentists supporting orthodontists is too low. You have taken the stand, some say, that you do not care; that you will get along without the dentist's support. How about the general public? I am thinking about the great good you will accomplish if you convince the dentist that he should support you. You must get down to the dentists and labor with them and show them the advantages which come to *their* clientele through *your* work, and you will thus accomplish much more than you are doing at the present time.

The Field of Osteoplastic Operations for the Correction of Deformities of the Jaws.

By W. Wayne Babcock, M.D., Philadelphia.

Read before the American Society of Orthodontists at Cleveland, 1909.

Mr. President and Members of the Society: It is unnecessary to remind you, whose specialty includes this very subject, of the importance of all methods useful in correcting deformities of the jaw. I may, however, emphasize the fact that your art has not merely a cosmetic, esthetic and utilitarian purpose, but that it may subserve also a deeper function—an influence on the very character of the individual treated. Especially is this true when the deformity treated is of high grade. It is marvelous how a timid, shrinking, diffident person, with a narrow, contracted chest and poor physique is transformed, by the correction of mouth-breathing, malocclusion or unsightly deformity, into an individual with initiative, stamina and force of character. Often the change in character is apparent within a few weeks after the operative treatment. Many of you, doubtless, can recall instances in which the timid have been made bold: the stupid, intellectual: the diffident and dependent, self-reliant, by the correction of abnormalities of the mouth or naso-pharynx. Who could conceive of a Napoleon, Wellington, Washington or Grant with a receding chin, with a highly arched palate, with adenoids or a marked degree of malocclusion?

Orthodontia is but a special field of surgery, as it, no doubt, has occurred to you. You have wonderfully specialized the mechanical measures for correcting the deformities of the jaw. As general surgeons, we can hardly keep pace with you and it is difficult for us to realize how much you can accomplish in a bloodless way. I am not sure but that orthodontia should be considered a part of orthopedic surgery, or the surgery which deals with the corrections of the various bodily deformities. Orthopedic surgery, at times, employs only the "dry" or "bloodless" surgical methods, such, for example, as those exemplified by Dr. Lorenz during his visit to this country. This is the type of treatment used by orthodontists, and it requires weeks, months or years for the attainment of desired results. Then there is the wet or bloody form of orthopedic surgery, which attempts to correct a deformity at once, usually by an open operation. The Lorenz operation, for congenital dislocation of the hip, is only applicable to young children, and then in only a percentage of the cases. For the others, there is left a cutting operation, such as that of Hoffa, which attempts the formation of a new socket. Likewise in correcting clubfeet, knockknees, bowlegs and the like, some may be treated by appliances, others require operative intervention. So it is in orthodontia; there is a residuum of cases requiring the knife. Strangely enough, orthopedic surgeons do not seem to have realized that the surgical principles they are successfully applying to other parts of the body may likewise be applied to the mandible and superior maxillary bone. That we may better realize what may be done with the maxillæ, it is important for us to understand what has been done with the bones of other parts of the body.

The Growth of Bones after Operations.

Bones depend for their growth, size and shape upon the law of adaptation of form to function. As the individual grows, the use to which the part is put determines its particular shape. The chief growth of bone comes from the periosteum or surrounding membrane. This is true of the mandible, and, to a lesser degree, of the superior maxilla. The regenerative power of the periosteum is remarkable. In the case of the femur, for example, if the shaft be removed, leaving the periosteum behind, and then if by a suitable cast or appliance the thigh is prevented from shortening, the periosteum may proceed to develop a new shaft. At first a flat layer of bone forms, but this gradually becomes rounded, and after a number of months the new shaft may show almost precisely the same shape as that of the original bone, so that the contour of the new femur, as shown by the X-ray, may finally be almost indistinguishable from that of the normal bone. Likewise with the tibia, which has a shaft with flat surfaces, as it re-forms after removal from the periosteum, it assumes in just the same way almost the precise form of the bone that was there before, with muscles reattached and with the grooves and eminences reproduced. This illustrates the wonderful reproductive power shown by the periosteum of the long bones of the body. Not many years ago, if the shaft of the tibia or femur were lost, the only thing to be done was to amputate the leg. Now we preserve the periosteum and look forward to the reproduction of a new bone.

Again, when pus formed under the periosteum, the surgeon formerly used the curette, and scraped away a part of the inner or bone-forming layer of the periosteum. The curette should never be used on the periosteum, and, as a rule, the greatest care should be taken in handling and preserving this membrane. If the bone be dead, leave it if you can safely do so, until the periosteum has thickened, acquired some strength and has loosened from the dead bone, so that the dead bone may be removed without injury to the periosteum. Not only has it recently been realized that we can, by preserving the periosteum, pave the way for the renewal of the great bones of the extremities, but it has been known for years that the mandible will often regenerate if exfoliated after necrosis. The only trouble has been the difficulty in holding the soft tissues, so that the new bone would be molded into proper shape. Also when we lose or remove a part of the mandible, it is possible to provide for its replacement or repair by utilizing the adjacent periosteum. If we have a gap in one of the long bones, and the periosteum is insufficient, by separating a flap of the periosteum from an adjacent portion of bone and by swinging the flap across the gap, one may provide for the repair of the defect. The connecting periosteal strip or bridge usually remaining after a fracture is especially valuable in favoring union of the broken bone. We may apply this principle of the periosteal bridge in correcting defects in the mandible.

If we divide the mandible, for example, and leave a marked gap between the divided ends of the bone, if a periosteal bridge be present, the gap will gradually be filled in with new bone, and a permanent alteration in the shape of the mandible may be secured with, perhaps, little loss in the strength of the bone.

The Sphere of the Surgeon in Orthodontia.

With this brief reference to the regeneration of bone, what aid may the surgeon be to the orthodontist? In the first place, surgery, as a rule, is not to be resorted to for the correction of minor defects, nor even for marked abnormalities that may be corrected by the known orthodontic procedures. I take it, however, that the jaw that is deformed belongs to the patient, and that the patient has the option of deciding what he shall have done to that jaw. The final decision must rest with the patient in many of the severe cases. The patient is to be advised as to the probabilities and dangers, and of the best course of treatment. If he has a deformity beyond the range of any orthodontic procedure, and he decides to elect surgical methods, after the risks have been explained, he should have the choice of doing so. If a patient have a very high grade of deformity, which will, perhaps, take a year and a half or two years for its correction, and if there be another method which will in a few weeks produce the result more surely, although at a greater risk, he should have the privilege of selecting that method. Again, the patient may not be able to afford a prolonged treatment by appliances, especially if the final outlook is very uncertain. If you can do without an operation, the patient will usually elect the orthodontic measure. It is to be left, however, to the patient largely, and what he elects we should attempt to carry out.

Hullihen's Operation.

As to the history of what has been done in these operations on the jaw, a brief summary may be permitted. It is, indeed, surprising how few operations have been done. Starting in 1848, Dr. S. P. Hullihen,* of Wheeling, W. Va., did the pioneer operation for an elongated jaw, with prognathism. We should name him with a great deal of pride. He had to do with a patient who had been under the care of some of the best surgeons in New York, only to meet with failure and rather an increase of the deformity. Anesthesia was not generally available, the germ theory and antiseptics were not understood, hemostatic forceps had not been invented and much in the way of surgical technique was yet to be evolved, but this man had the hardihood to go ahead and do a series of very extensive operations upon this girl's jaw and neck which resulted in a remarkable improvement, if not a complete restoration. The case was that of a girl of twenty years, who fifteen years before had been so badly burned over the neck that the jaw was pulled down upon the chest, and there had been produced an elongation of the mandible, a protrusion of the lower incisors and marked eversion of the lower lip.

With a small saw, V-shaped sections were resected from each side of the jaw, the section upon the left side including the bicuspids. The V-shaped sections extended two-thirds of the way through the bone, the apices being below (Fig. 1). From the apices the saw was turned horizontally forward, completing the section, and leaving the upper two-thirds of the anterior portion of the mandible attached to the soft tissues of the lip only. With the removal of the two V-shaped sections of bone the mobilized portion of jaw could be pushed back into place, securing an occlusion of the incisors (Fig. 2). From an impression taken in soft wax a silver plate was then struck up which, when applied, held the section of the jaw in proper position. Union rapidly occurred and Dr. Hullihen then boldly proceeded to correct the defect in the neck. A large flap of skin from the shoulder and upper arm was transplanted to the neck, enabling the head to be raised, and finally by two further operations the everted and deformed lower lip was made sightly and useful. All of these operations are said to have been successful.

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* "Elongation of the Jaw and Distortion of the Face and Neck Caused by Burn Successfully Treated."—*American Journal of Dental Science,* 1849, Page 157.

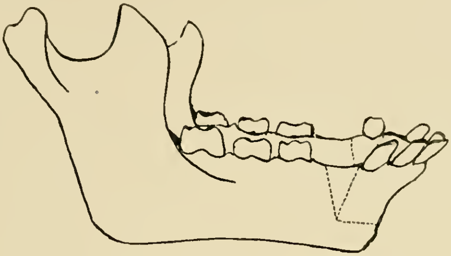

FIG. 1.

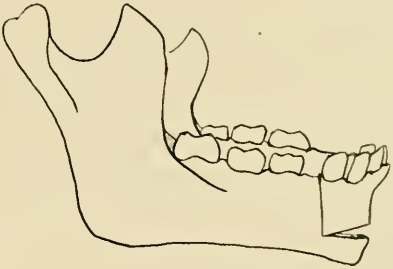

FIG. 2.

Fig. 1. Diagram showing the type of deformity in Hullihen's case, the dotted lines indicating the lines of bone section and the triangular segments of bone to be removed.

Fig. 2. Diagram indicating the correction of the elongation of the jaw in Hullihen's case by the removal of triangular segments of bone. The vitality of the mobilized portion of the bone was maintained through its vascular attachments to the under lip.

Nearly fifty years elapsed before bilateral resection of the mandible was again suggested. In 1896 Dr. R. Ottolengui,* in discussing the sub-

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*Discussion Union Convention, Rochester, New York.—*Dental Cosmos*. 1897, Page 143; Fowler, ITEMS OF INTEREST, January, 1897.

ject suggested the feasibility of such a procedure, and the following year Dr. James W. Whipple,* of St. Louis, referred to Dr. Edward H. Angle a patient, a young man, with a progressive type of prognathism. After studying this patient, Dr. Angle advised a bilateral resection of the elongated portions of jaw, between the first molar and the second bicuspid on the right side, and the first and second bicuspid on the left side; the sections removed differing from those removed by Hullihen, inasmuch as the removed segments passed through the entire depth of the body of the jaw. This operation was not performed by Dr. Angle, and the patient finally came under the care of a surgeon, Dr. E. P. Blair, who resected a quadrilateral section from either side of the jaw, brought the teeth into occlusion, wired them in place, and then found great difficulty in holding all the fragments of the jaw in occlusion. However, after nine quite troublesome weeks from suppuration and some necrosis, bony union and a very creditable result were obtained. The publication of this operation led to a few similar operations, which, in some cases, were followed by necrosis, one patient in New Orleans losing the mandible from this cause. Although this operation is performed through incisions from below the jaw, the two compound fractures into the mouth which are produced are so objectionable that a preliminary extraction of teeth, to be followed later by a submucous resection of bone, has been advised. Besides these operations, Von Bergmann, a noted surgeon of Berlin, had corrected the deformity of a receding chin by resecting the processes, and moving the body of the mandible forward where it was held by an artificial dental apparatus.

The possible advantage of a somewhat different type of operation for the correction of prognathism was suggested to me by observations made in a case of a young man who applied for treatment of another condition. The history of the patient is as follows: Samuel K., aged 18; a negative family and previous history, except for recurrent attacks of tonsillitis during the past two winters.

Condition Found on Examination.

The tonsils were large; there was a moderate increase of adenoid tissue in the nasal pharynx; the nasal septum was inclined slightly to the right, and there was a chronic rhinitis of the hypertrophic type. The patient breathed almost exclusively through the mouth; the palate was highly arched, the dental arches were symmetrical and the teeth fairly regular, although short and poorly developed. Only a single molar on the left and two molars on the right side could be imperfectly oc-

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*Double Resection of the Inferior Maxilla for Protruding Lower Jaw.—*Dental Cosmos*, 1898, Page 552.

cluded, the minimal separation between the upper and lower central incisors being 7 mm., and the lower centrals being in a plane at least 5 mm. in front of the upper centrals. The chin was rather pointed and prominent, and the patient said that, although the teeth had probably never been in good occlusion, the condition had progressively increased during the past four years. The lips were long and the teeth did not show in ordinary conversation, so that the patient had been repeatedly asked if the teeth had been lost. In smiling and in talking the lips tended to curl in over the teeth, producing an unpleasant expression. In talking the tip of the tongue rested against the lower lip instead of the teeth, so that enunciation had a mumbling character resembling that of an edentulous person. The patient could not bite hard or thin masses of food except by introducing them far into the mouth. Mastication was very imperfect, the food being bolted after a slight attempt at mastication. The lips were kept almost constantly open except during speech. The patient was moderately well developed, but the chest was long and narrow. He was constipated, but did not complain of indigestion.

Choice of Measures of Relief.

The young man had presented himself for *acne vulgaris*, but the ugliness of the facial profile led me to examine the jaw and then to consider the possibility of surgical relief. At once it occurred to me that a section of both rami would be the operation of choice, but on investigation, to my surprise, I found no evidence that such an operation had ever been done previously. The patient was referred to Dr. S. H. Guilford to make sure that relief could not be obtained by any form of dental appliance. Dr. Guilford agreed as to the necessity for surgical intervention and suggested the operation of Angle. This operation seemed to me objectionable for the following reasons:

Objections to Angle's Operation.

1. It would necessitate two compound fractures of the lower jaw.

2. At least one tooth with the adjacent process would have to be removed on each side, and in the removal of these two teeth the exposure of the roots of two adjacent teeth on each side of the mandible would be almost inevitable. Thus two teeth would be sacrificed, and four additional teeth placed in jeopardy.

3. The inferior dental canal with its vessels and nerves would be divided on each side.

4. The arch of the lower jaw would be broken into three portions, would be contracted and would require a special retentive appliance.

5. As the surface of bone would be exposed to the action of the saliva and to infection in the mouth, a greater or lesser degree of necrosis would be almost inevitable.

In one instance this operation had been followed by loss of the mandible from necrosis.

The division of the inferior dental nerve seemed the least of these objections, as this nerve often reunites after division, and even were the local anesthesia, resulting from the division, permanent, the condition is not a very troublesome one. As contrasted with this operation a section through the ramus (1) would be free from dangers of a compound fracture within the mouth; (2) would not reduce the size of the dental arch or jeopardize any of the teeth; (3) if carried out above the level of the spine of Spix need not involve the inferior dental nerves of vessels; and (4) as the bone could be reached from without the mouth under aseptic precautions, the danger from aspiration would be slight, even should suppuration or necrosis ensue. The septic fluids would be discharged externally and not pass into the mouth to be swallowed or be aspirated in the lungs; (5) the proper occlusion could be produced if necessary by external pressure through a chin-cup, if need were, without the use of any interdental appliance.

As an objection to a section of both rami, my attention was called by Dr. M. H. Cryer to the narrow antero-posterior diameter of the pharynx, and the danger of producing suffocation by carrying the lower jaw and the attached tongue backward. As the support of the hyoid bone would not be changed by the operation, and as it seemed to be quite feasible to reproduce the deformity, should signs of suffocation follow from the procedure, the following operation was undertaken:

Operation.

The patient was narcotized by scopolamin-morphin, reinforced by a small amount of ether, December 5, 1908, and an incision carried through the skin and subcutaneous tissue over the posterior border of the ramus of the jaw from the zygoma to a point under and anterior to the angle of the jaw. This incision was not carried through the deeper tissues for fear of injuring branches of the facial nerve and parotid duct. The outer fibers of the masseter muscle were separated and the external surface of the middle of the ramus exposed. With a small chisel a transverse section was then made through the ramus. The operation was repeated on the other side, and the body of the jaw then forced back, and the teeth placed in the best possible occlusion. To facilitate this, a triangular segment of the ramus was removed on one side, a procedure probably unnecessary and undeniable. The opening in the muscle, fascia and external wound was then carefully closed by buried sutures of catgut, certain of the lower teeth wired to the upper and an external plaster bandage applied. No symptoms of suffocation were produced, but on awaking the patient complained that there was insufficient room in his mouth for his tongue, and that he had difficulty in breathing through his nose. The occlusion of the jaws closed the lips and made them appear redundant.

Post-operative History. In the after course of the case it was found that the contraction of the masseter muscles and the depressers of the jaw, by closing the triangular gap in the ramus, tended to separate the jaws anteriorly. The wiring of the teeth was found to be insufficient and was discarded. Through Dr. Guilford, and at the advice of Dr. Cryer who kindly became interested in the case, an interdental splint was constructed, but this, likewise, was not found of much advantage, so that recourse was had to pressure of an ordinary chin-cup connected by elastic bands to a head-piece. By regulating the tension of the bands, it was found possible to bring the teeth into occlusion. This appliance was worn about nine weeks to give sufficient time for the new bony tissue to fill the gaps in the rami, but two weeks or more before the appliance was removed, the patient began

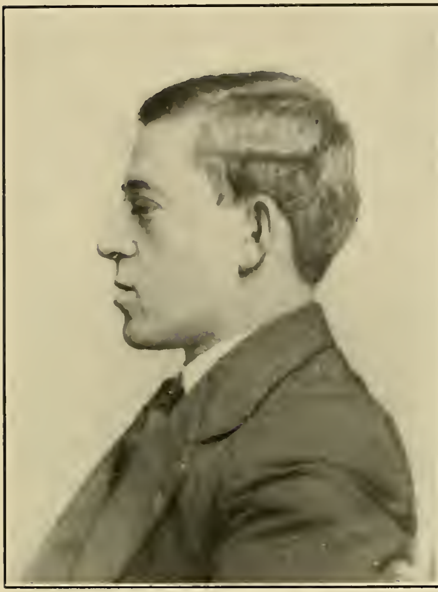


FIG. 3.

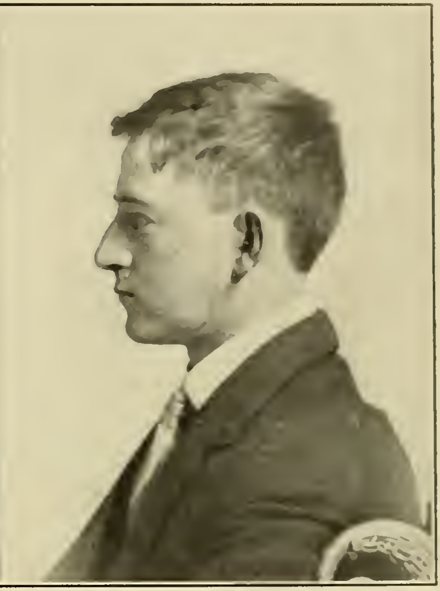
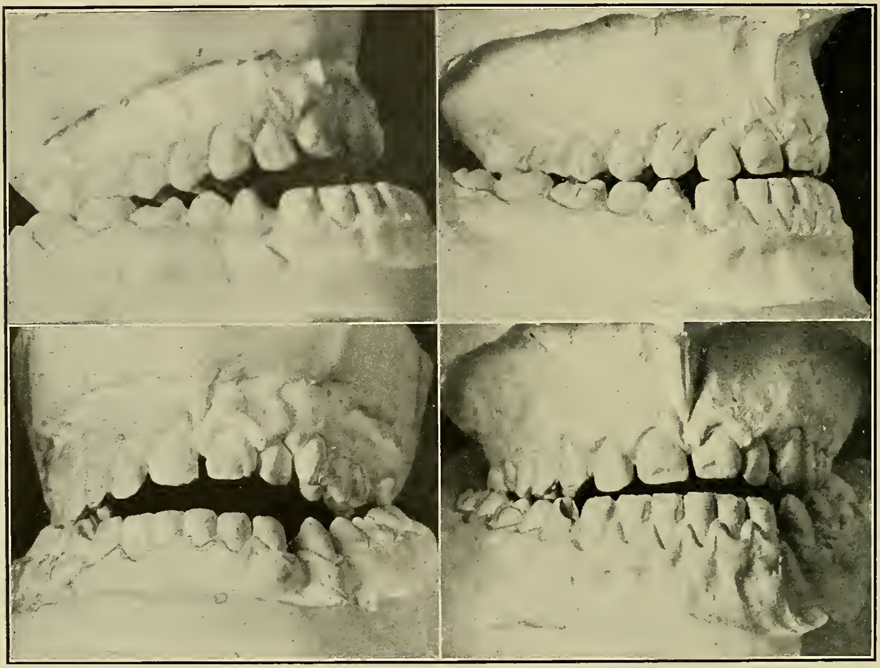


FIG. 4

Fig. 3. Case I. Showing the profile in the case of S. K. prior to operation.

Fig. 4. Case I. Showing the profile of S. K. about three months after the operative division of both rami.

voluntarily to separate and to use the jaws. There was no tendency to ankylosis, and the lateral and vertical movements of the jaw were well retained. As a result of the operation, the patient's appearance has been greatly improved, the lips have become shorter, the chin less prominent, the mouth is kept constantly closed, the enunciation of words is better, nasal respiration has been spontaneously established, food is properly masticated, the tongue is no longer kept between the teeth, the chronic constipation has disappeared, and, possibly as a result of the operation or the cessation of mouth-breathing, there has been no attack of tonsillitis this winter, although the tonsils remain enlarged and the nasal catarrh continues (Figs. 3, 4, 5, 6, 7 and 8).



Figs. 5, 6, 7 and 8.

Figs. 5 and 6. Case I. Casts showing the malocclusion prior to operation.

Figs. 7 and 8. Case I. Casts showing degree of occlusion obtained through the transverse division of the rami.

For those who consider enlarged tonsils, adenoids and nasal obstruction a cause of mouth-breathing and of faulty development of the jaws, we have here some suggestive evidence that the correction of deformities of the jaw may conversely, at times, be followed by the spontaneous disappearance of the nasal obstruction and by failure of the large tonsils to produce symptoms. By this we, of course, do not mean it is desirable, as a rule, to retain adenoids and enlarged tonsils. This first case illustrated the desirability of having accurate and strongly anchored interdental splints made previous to the time of operation, which should enable one to secure, during the operation, occlusion, fixation and immobility, to be maintained until firm bony union had taken place. In the operation, when the teeth are brought in apposition, a certain gap is formed between the bony fragments, but if a bit of periosteum bridge this gap, new bone will form and fill the area.

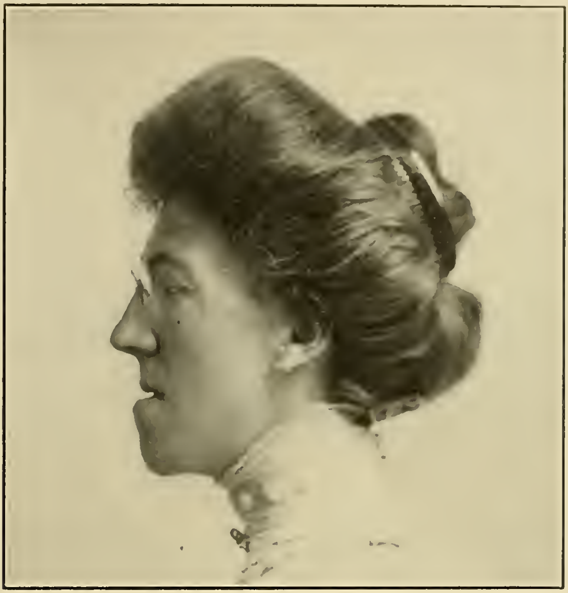


Fig. 9.

Fig. 9. Case II. Showing profile to operation.

Inferior Prognathism, Malocclusion, Contracted and Deformed Arches.

Case II. Miss M. H., aged 29 (Fig. 9). The former history is negative, there being no evidence of any prognathic condition or other deformity in the patient's forbears. She was born in Philadelphia and when five years old had scarlet fever, followed by meningitis which confined her to bed for one year. There was a discharge from the ears and abscesses formed. This condition was attributed by her physician to her teeth, and he referred her to the dentist for over-lapping of the cuspids. For the purpose of regulating, four teeth were extracted from both the upper and lower jaws. In all, one molar and one bicuspid on each side had been removed from the upper jaw, and two molars on the left, and one bicuspid and two molars on the right side had been extracted from the mandible (Fig. 10). A growth of new tissue formed in the pharynx which was apparently removed; whether this was hypertrophy of the tonsils or adenoids is not known.

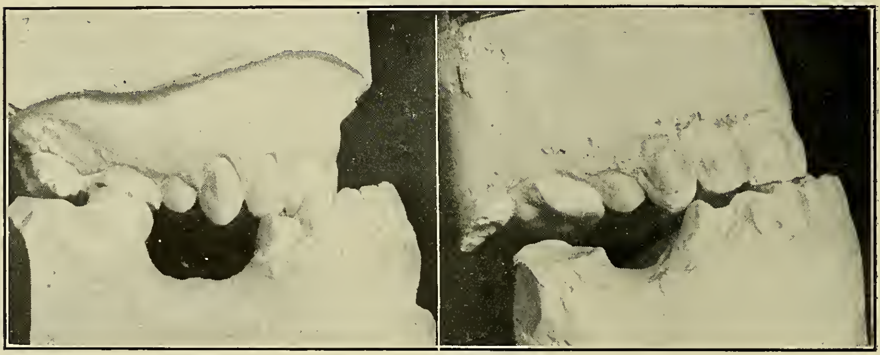


FIG. 10. FIG. 11.

Fig. 10. Case II. Articulated cast showing maloclusion prior to operation.

Fig. 11. Case II. Articulated cast indicating approximate occlusion after operation. The early correction of the deformity was partially lost through the refusal of the patient to submit to the further application of orthodontic appliances.

Present Condition. The lower incisors are one centimeter in front of the uppers and two millimeters to the right of the median line. The plane of the occlusal surface of the lower incisors is about three millimeters below that of the uppers. The patient is unable to eat hard or tough food; she can not bite an apple although she can bite off a piece of bread or similar substance. The jaws are easily tired and attempts at mastication are very wearisome. She has suffered for years from debility; faintness under slight provocation; has indigestion most of the time; is very nervous; has a slight enlargement of the tonsils, especially on the left; the nares are very small; there is a marked septal deflection to the right with obstruction, and an enlarged lower turbinate on the left side. She has an extremely high saddleshaped or vaulted hard palate. The arch of the jaw is so constricted that the tongue can not be retained within the mouth, but is constantly protruded, and so exposed in the basin-like projecting portion of the mandible. The prognathism was first noticed when the patient was about thirteen years old, after which it rapidly increased.

Operation. Through Dr. Thomas Weeks, silver interdental splints were constructed with protruding lugs to enable the mandible to be firmly wired to the upper jaw. Using shorter incisions than those employed for the first case, a transverse division of each ramus was made by a chisel. On attempting to occlude the teeth it was found that the mouth was so small that the teeth could not be approximated on account of the size of the tongue, and the projection of the lower molar. Bandages and a chin-cup with head traction, were, therefore, applied, and in the course of a few days we found that the tongue had so adjusted itself within the mouth that after extraction of the two molars the teeth could be brought nearly into occlusion. The interdental splints were then applied, being wired and cemented to the teeth, and by wiring we finally secured occlusion such as is shown by the model (Fig. 11). Unfortunately, the approximation was not perfect, as the splints slipped from the teeth and had to be reapplied. When we finally removed the splints we found that the size of the tongue was such as to produce a constant force tending to reproduce the deformity; and it then became evident that the upper arch should have been widened by orthodontic measures previous to the time of operation, and that more secure interdental splints should have been constructed. Unfortunately, as so often occurs with mouth-breathing, the patient had little stamina, and she did not properly cooperate in the work. It was difficult to persuade her to submit to any operation, or to permit the continuance of any appliance in the mouth and at the present time she will permit no regulation whatsoever to be done. By this case we were taught the value of associating orthodontic measures, in certain cases at least, with the surgical procedure, and the importance of having very strong interdental splints made in sections and firmly anchored to the upper and lower teeth before the operation, was impressed upon us. To secure better occlusion it was found desirable to cut off the cusps of the interdental splints so that the teeth could come in direct contact. I would estimate that the initial tension required in his case to put the teeth in apposition was, perhaps, fifty or seventy-five pounds, a stress much greater than that usually placed upon interdental splints. The advisability of dividing the ligaments of the lower jaw by tenotomy so as to permit a greater separation of the posterior portions of the jaw and greater room for the tongue is to be considered as it would doubtless have facilitated the after treatment and possibly have enabled us to avoid the extraction of teeth.

Case III. A third patient, Mr. I. F., aged 22; tailor by occupation. The mother is prognathous, but other members of the family are free from the deformity. The jaws are large and the type of deformity is shown in Figs. 12, 13 and 14. The condition, owing to the large size of the dental arches and the capacious mouth, is well adapted to correction by resection of the ramus. In addition to this, regulation of the teeth is required. This patient has not yet come to operation.

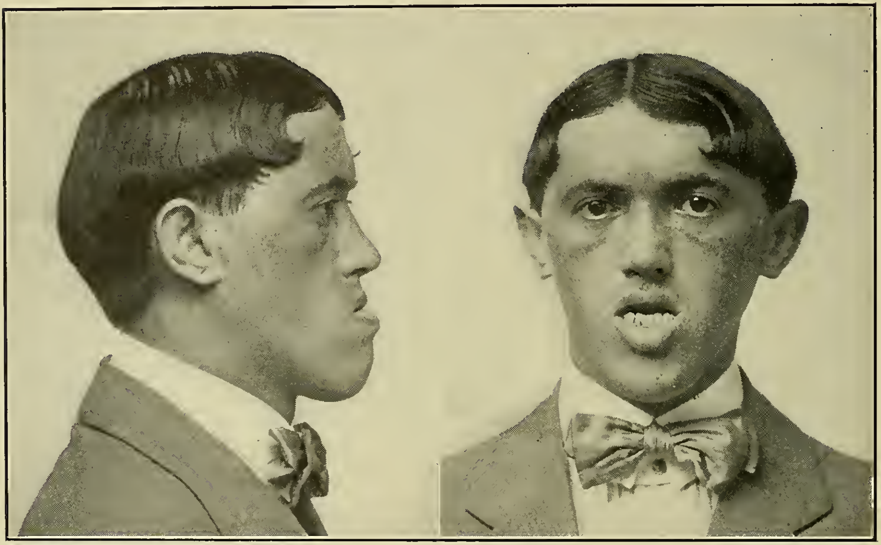


FIG. 12. FIG. 13.

Fig. 12. Case III. Profile showing the character of the prognathism.

Fig. 13. Case III. Anterior view.

In cases such as the second type, there are certain other points to be considered. We have to consider not only the muscular tension which is produced after dividing the ramus, but we have to consider the ligaments of the jaws. Where you divide the ramus through the center, the two internal ligaments—the spheno-mandibular and the stylo-mandibular, if undivided—serve as strong unyielding cords, preventing the lifting of the chin. Where we deal with deformities of the other joints, such as clubfoot, for example, we relieve such tension by a tenotomy or a division of the ligaments. It seems to me that we must at times adopt a similar procedure here. We must divide these ligaments close to their point of attachment, and then stretch the muscles in order to secure better apposition and less strain.

Many of these deformities are associated with a very obtuse angle, and in lifting the body of the jaw up one must at the same time increase the distance between the articular surface and the angle of the jaw; or, in other words, lengthen the ramus. Should it be necessary to markedly lengthen the ramus, then one has the alternative of applying great force or of dividing the ligaments. Where it is merely necessary to slide the body of the jaw forward or backward a moderate distance, then the tenotomy may be unnecessary. The chief point I should like to make is this: With a bilateral division of the ramus, we can separate and mobilize the body of the jaw so that it may be moved in any direction, from side to side, forward in the case of retreating chin, or backward for prognathism. It may be tilted if desired, and after any one of these procedures, if the body of the jaw be immobilized by splinting, the gaps that have been produced in the ramus will be filled by a deposit of new bone, especially if a periosteal bridge has been left, or if the gap be not too great. Union usually occurs in about four or five weeks. Indeed, the union is so rapid that after divisions of the ramus for ankylosis, that it is difficult to prevent the bony fragments from reunion, unless a portion

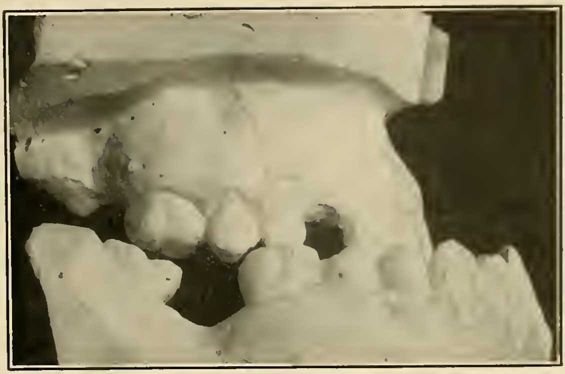


FIG. 14.

Fig. 14. Case I. Indicating the character of malocclusion prior to operation.

of the muscle or some other soft tissue be interposed between the bony fragments.

Methods of Operating.

As to the methods of dividing the ramus, this will depend largely upon the experience of the individual operator. The operation should not be difficult to one accustomed to operating upon bone. The simplest procedure is probably a subcutaneous osteotomy similar to that used in dividing the long bones in the body. A narrow chisel or osteotome is thrust through the skin to the bone, turned so that the cutting edge is transverse and driven thorugh the bone by a mallet. It is repeatedly withdrawn, and adjacent portions of bone gradually divided, until complete division is accomplished. This operation is done by the sense of touch alone. This procedure leaves practically no scar, the puncture of the chisel may not even require a suture, but some expertness in the use of an osteotome is desirable. The division of the bone by an osteotome is easier after exposing the bone through an incision; if an incision is made, it should pass behind the ramus or curve around the angle of the jaw in such a manner that the scar will not be conspicuous. Besides the chisel, ordinary bone-dividing instruments may be employed, such as

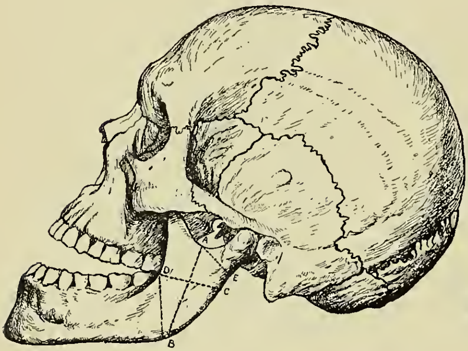


FIG. 15.

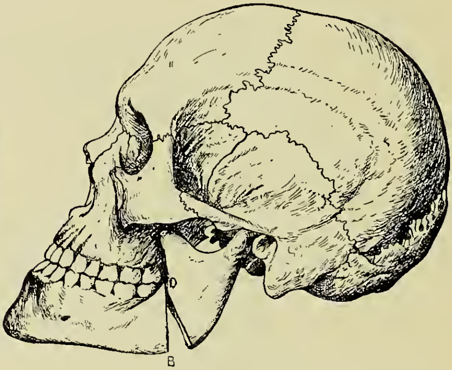


FIG. 16.

Fig. 15. Diagram showing maloclusion and prognathism. The dotted lines indicate the possible lines of section in correcting the deformity by division of the ramus. D C indicates the line of section employed in case I and case II.

Fig. 16. Diagram showing the result of correcting the deformity by division of the ramus along the line D. B. This line of section divides the inferior dental canal, but as it is below the more important muscular and ligamentous attachments, it permits a greater mobility than the higher line of section.

a bur or small saw actuated by a surgical engine or the spiral osteotome of Sudeck or Cryer. An ingenious method has been suggested by Dr. V. P. Blair, who makes a vertical incision one-half inch in length posterior to the ramus, through which a heavy needle is passed into the incision behind the ramus, and then brought out through the cheek. By means of the needle a Gigley saw is pulled through the tissues. A small metal tube is slipped over the saw through the puncture in the cheek, so as to prevent laceration of the face, then by simply pulling the saw backward and forward, the ramus is divided. If desired, the ramus can be divided from within the mouth. We have rather frequently exposed the inner surface of the ramus in dividing, or injecting, osmic acid into the inferior dental nerve and have had no serious trouble from necrosis of the bone, a condition always to be feared in the exposure of bone from within the mouth. The Paravicini's incision is used, which is a vertical incision through the mucous membrane to the inner side of, and in front of, the anterior edge of the ramus. Through this incision the tissues may be separated from the inner surface of the ramus, and the bone divided by means of a chisel, bur or other instrument.

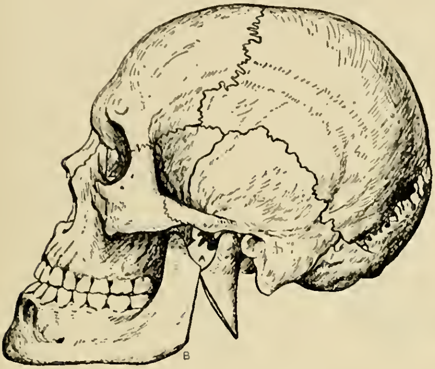


FIG. 17.

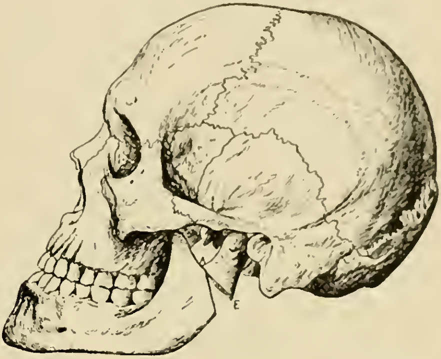


FIG. 18.

Fig. 17. Showing the displacement of the bony fragments by correcting the deformity with the incision A B.

Fig. 18. Correction of the deformity by division of the ramus, at the base of the condyloid process: a line of incision most apt to be followed by the formation of a false joint.

It is evident, therefore, that quite a series of corrective operations may be applied to the jaws. In some cases it may be wise to reduce the size of the arch by the method of Hullihen or Angle. Again, we may desire to mobilize and shift the alveolar process, or, retaining the full size of the arch, we can mobilize the body of the jaw by incisions through the ramus by one of the methods just described. In making the section through the ramus, in some cases, instead of transverse section, an oblique section, made from the angle of the jaw upward and forward may be of advantage in avoiding ligamentous and muscular attachments and so enable one to secure greater mobility to the body of the jaw. Some of the operations we have alluded to may be applied in a modified way to the upper jaw, but orthodontic treatment has been so successful in correcting deformities of the superior maxilla that I take it, it will rarely be desirable or necessary. It has been demonstrated, however, in surgical operations for the removal of the tumors of the pharynx and nose that one may divide the superior maxillary bones in the median line and so separate them as to secure access to the pharynx. In like manner the upper arch may be broadened. Again, accidents and operations show that the lower portion of the superior maxillæ, including all of the alveolar process, may be separated from the bone and so mobilized as to permit the superior dental arch to be moved or tilted. The bone may be divided on a horizontal plane well above the alveolus, as has been shown by Kocher, for the removal of tumors. The operation, however, is bloody and rather difficult, and is a far more serious operation than nearly any of the operations described for the lower jaw. I think it important that dentists

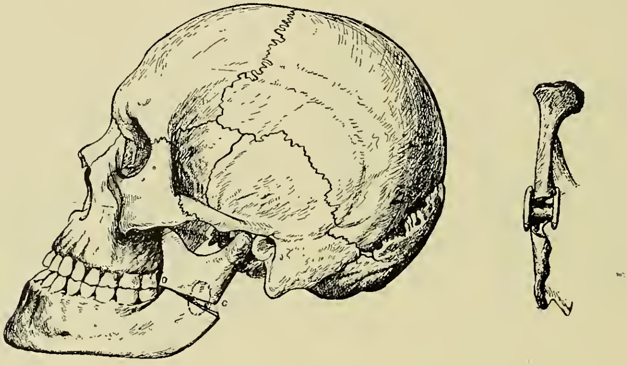


Fig. 19.

Fig. 19. Correction of the deformity by transverse section of the ramus, the smaller figure indicating the application of an ivory or metallic button to fix the fragments. This incision does not necessarily involve a division of the inferior dental angle, and it is specially adapted to those cases in which it is merely necessary to move the body of the jaw backward or forward.

should realize what operative procedures upon the jaw are at present available. I think it also very important that surgeons should acquire a better knowledge of orthodontia, and that they should try to perfect this special form of surgical practice.

Discussion of Paper by Dr. Babcock

Dr. Rogers. Mr. President and Fellow Members: It is a pleasure to open the discussion on this valuable paper just given us by Dr. Babcock. I am somewhat at a loss to know why the chairman of the Board of Censors has given me the honor, as I am wholly lacking in experience in this work. We all know that experience is the great teacher, and the man without experience should, perhaps, say as little as possible when called upon to discuss matters before more experienced men. In speaking of experience, I am reminded of a story told of Oliver Wendell Holmes. It seems he once ordered a calf from a farmer to be left in the barnyard. When the calf arrived, Dr. Holmes went out and tried to induce it to go into the barn, but did not succeed. He finally secured the aid of his son, and both worked arduously, but still the calf refused to move. During the procedure a servant girl stood at the kitchen window, and seeing that Dr. Holmes made no headway, finally came out. Without a word she walked quietly up to the calf, and placing her finger in the animal's mouth, walked into the barn with it. Dr. Holmes watched her closely until she disappeared, then, turning to his son, remarked: "Son, we have yet much to learn." That is the way I feel to-day about this operation of Dr. Babcock's. We have much to learn, and those of us with little experience in the work can merely sit by and listen to the experiences of these men who are so expert with the chisel, and who have known enough to "put the finger in the mouth," where we have been doing the same work by pulling and hauling.

The authentic history of this operation is valuable and interesting to us. We are proud of it, because so much of it has been given to us by men in our own profession. Long lapses of time seem to appear between the early strides of science, but after a time as more minds become interested, the strides become more rapid. So I believe with this operation more rapid progress will be made in the next few years. In a few years, perhaps, it will be a quite common operation. But we must have a more definite understanding of our own limitations along these lines. We have, so far, made but a beginning. The results we seek are being but partially attained.

The primary fault, if there is a fault, must rest with the dental profession for allowing these cases to develop. As time goes on there will be fewer cases reach men like Dr. Babcock, because, as he says, many of them were mutilated early in life. But there is great hope for those cases that have passed beyond the care of the orthodontist, for they may be helped by their operation.

The reports of cases given by Dr. Babcock were extremely interesting. We are glad to note the wisdom he has used in the selection of his point of attack. Dr. Babcock would have made a good general, because he has avoided, in this operation, the points of danger, and then after the operation has left the field in good shape. He has not destroyed the relation of the parts so much as the former operations have done. Dr. Babcock has experienced some difficulty in holding the jaws together after the operation. It has occurred to me, from an experience in the correction of a severe case of fractured jaw, that there are certain methods which might be used, such as an apparatus attached very firmly to the teeth on both arches. In the particular case alluded to, very heavy platinum wire was applied in such a way that after the operation was completed, it was absolutely impossible for that jaw to move in any way. Not being enough of an artist, I shall not attempt a diagram of the appliance at this time. No doubt Dr. Babcock might be able to use the method of which I speak in his future operations, and thus be enabled to discard the chin-cup and all those things so troublesome to the patient.

One or two points referred to in the matter of the correction of receding jaws, I have as yet to seriously question, possibly because of my lack of experience. It seems to me in our studies of the receding mandible, it is not always, nor even often, that we have a lack of growth so much as malposition, and I believe that those cases can be very much better handled through the orthodontic treatment. The surgeon, as a rule, does not understand our science thoroughly, and as I said in the beginning of my discussion, we must bring ourselves to a closer understanding, learning each the other's limitations; then we can go ahead more definitely.

Dr. Federspeil. I want to extend my compliments to Dr. Babcock for his valuable suggestions concerning osteoplastic surgery of the jaws. I have not had a very large experience relative to osteoplastic surgery of the mandible, but have done considerable work on the upper jaw, such as operations for cleft palate, benign tumors, etc. I have a case in mind which was the most pronounced protrusion of the upper maxilla I ever saw. The upper arch was protruding almost two inches beyond the lower. The patient was financially very poor and could not undergo orthodontic treatment, and I doubted whether it would have been possible to correct the deformity by orthodontic methods. The patient was anesthetized and I extracted the four upper incisors, and the prominent portion of the alveolar process was resected; the mucoperiosteal flap was then laid over the part of bone removed and sutured.

After healing, the patient was sent to the family dentist who put in Steele's interchangeable teeth and thereby made a nice looking mouth.

Many of these cases which are beyond the skill of the orthodontist can be improved by surgical methods.

Dr. S. Merrill Weeks. I am very glad to have opportunity of expressing the pleasure I have had in this particular paper, especially because it has been my privilege to see Dr. Babcock's patients. The first one he spoke of I have seen since the operation, and I assure you all he has said, and more, is true of the case. I feel we are very much indebted to him for the progress he has made, and we may almost say it is the initial work in this particular line. The vitality of the lower teeth in these operations is a very marked improvement over the operations exhibited in the past. I think we, as orthodontists, will appreciate as time goes on the need of assistance in our work in these extreme cases, and, of course, Dr. Babcock claims those are the only cases in which he would recommend such extreme measures. With the disadvantages of age and extreme development along those lines, I believe we are powerless to get the results that may be had by such work as he has been doing.

As to the technique of retention, etc., I think Dr. Babcock will find the details of that will work out in the future to his entire satisfaction. Perhaps we can be of some assistance to him from that point of view. The society should be congratulated upon having heard this paper.

Dr. Fischer. I am very glad, indeed, to have heard Dr. Babcock, and regret that Dr. Blair was not here to discuss the paper, for it seems to me that Dr. Babcock and Dr. Blair have come to rather similar conclusions. I know Dr. Blair has had much difficulty in retaining his cases. The pressure is simply tremendous, and the orthodontist is usually surprised to learn that most orthodontia bands are entirely inefficient. I have been present at a number of Dr. Blair's operations, and one remark made by Dr. Babcock impressed me. He said he made an incision along the ear in order to get access to divide the ramus. Dr. Blair has made an incision below the ear, only half an inch long, and then, with one of the curved needles on a long handle, he has started a ligature through on the inner side of the ramus above the entrance of the inferior artery and nerve and between that and the bone proper, and coming out upon the face anterior to the ramus with but a small opening. He then pulls a ligature through sufficiently to tie to a Gigley saw. He slips a tube on the saw to protect the cheek from laceration. The subsequent healing will then leave no scar.

Dr. Kemple. I would like to ask Dr. Babcock what difficulty he experienced in taking care of the soft tissues. For example, where he removes a section of the ramus to bring the adjoining parts together, and also how long that great strain on the interdental splint, or whatever appliance is used, is continued. Dr. Rogers spoke of making an appliance that could be attached to the teeth, and doing away with chin-cups, etc. It requires a very slight constant force to draw a tooth or a number of teeth out of their sockets, and if that force were continuous for any extended length of time I think you would have an opening of the jaws with almost any kind of interdental splint, unless you used some auxiliary device to prevent it. I would like to know how long that force is continued.

Dr. Ottolengui. As Dr. Babcock has done me the honor to mention my name in connection with a suggestion made some years ago in regard to the feasibility of this operation, I would like to give you a very brief account of the operation which gave me this idea. Some time in 1896, Dr. George R. Fowler, a prominent surgeon of Brooklyn, consulted me in regard to an operation which he was about to perform for an epithelioma in the region of the throat. In order to obtain better access, he desired to divide the ramus, and he asked me if I could construct a splint which would guarantee normal occlusion after the operation. As the young woman had a magnificent set of teeth in ideal occlusion, and the splint could be made in advance, I readily agreed to undertake this part of the treatment.

I constructed a rubber splint which separated the two jaws sufficiently to allow for a feeding space, as was customary in those days. The operation was performed, the two parts of the severed ramus reunited by wire, and the splint put in place readily; but twenty-four hours after the operation, when I visited the patient, I noted that the splint held the severed ramus slightly apart, and I realized at once that if this gap should be filled across with bone, it would be impossible, after the operation, for the patient to bring her teeth into proper occlusion. With the consent of the surgeon, therefore, I took new impressions of the two jaws, swedged up very thin continuous caps of pure gold, and, placing these together on an articulator, united them with solder. This splint was used with great satisfaction and with the result that the teeth, after the operation, fell into exactly the same occlusion as before.

In making a splint of this kind, it is advisable to cut out a portion of the splint, so as to disclose the labial surfaces of the anterior teeth. By this means it is easy to be sure that the bandages hold the jaws firmly into contact with the splint.

I think these cases, where the healthy jaw is intentionally divided, must be treated differently from fractured cases, and that it will prove to be essential, in order to obtain the desired occlusion after an operation, to devise such splinting methods as will maintain the teeth as accurately as possible in the occlusion relations planned. I believe that for this purpose a double splint would prove advantageous, although it may be necessary as an auxiliary to the splint to make use of some method of ligating the jaws together also. By this means the intermaxillary splint will prevent lateral motion, while the ligatures may be relied on to secure the jaws within the splints by exerting vertical stress.

Dr. Waugh.

I have had the privilege of assisting in the treatment of some fractures, and it is our custom to make models of the mouth and saw the model of the fractured jaw and put the parts in apposition, getting the occlusion from the models and then making a rubber splint. Rubber is cleanly if properly handled, and if one feels the need of steady strain, I have added an inclined plane of rubber, and by using the cap and chin-piece and strong rubber bands the jaw can gradually be drawn into place. In two cases I remember telling the patient to try to close the mouth, the teeth went with a snap into position.

The casting process is an excellent method. Make the splint in two or three sections and unite those in the mouth, soldering as necessary thereafter. Casting will come in very nicely, in that it will permit the contact of the cusps in a more exact way than can be obtained by swaging.

If, in making splints, anyone is ever compelled to bring about an opening of the mouth, proper occlusion of the teeth after the splint is removed can not result unless you have used some means by which you have established the relation of the teeth with the joint, and then you may mount it on any articulator you choose, but you must have the exact relation of the occlusal plane to that joint, when opening it and the teeth will afterwards go to place. If you have been accurate in your work, you need not fear those difficulties where you are compelled to have an opening in the anterior region for feeding, or for any other purposes.

Dr. Strom, Landau, Germany.

In listening to this most interesting paper, I was reminded of an operation two years ago in the Royal Hospital in London. The surgeon used a curved knife, two and a half inches in width. He cut the alveolar process in different sections, using forceps, the beaks of which were padded, hard rubber being used on the labial surface and soft rubber on the lingual. He applied a splint and said that in a fortnight it would heal and stay in position. I think Dr. Visick knows more of this case than I do.

Dr. Hedley C. Visick, London, England. It is very kind of Dr. Strom to mention my name in reference to this subject, but I can not claim to have had much experience with these cases of surgical correction of malocclusion. I remember one case which came under my notice at Guy's Hospital in London. Patient, a boy aged about twelve years. He came to the Dental Department with the following condition: The upper right cuspid was in lingual occlusion, being hopelessly locked in position by the lower teeth. There was plenty of room between the right upper lateral incisor and first bicuspid for the cuspid to be moved into position, and as it was the only misplaced tooth in either arch, immediate surgical treatment was decided upon. The upper right lateral incisor and first bicuspid were banded, and a plaster impression taken. The two bands were then joined by a wire, which passed lingually to the cuspid when placed in normal occlusion. The patient was then anesthetized with nitrous oxide by the nasal method, and the tissues in the vicinity of the cuspid were thoroughly swabbed with antiseptic lotion. Incisions were then made through the soft tissues and alveolus on either side of the cuspid by means of a hand saw, to the depth of about fifteen millimeters. A pair of stout forceps were used, with a T-piece covered with soft rubber on the outer blade, which was placed high up in the sulcus above the tooth to be moved. The inner straight blade was then forced up into the bone on the palatal side of the cuspid, and strong outward pressure was brought to bear on the tooth and surrounding bone. By this means the tooth and surrounding bone were bodily moved forward into correct position and the splint forced into place. When the patient had recovered from the anesthetic, the splint was removed and then cemented into position. The patient suffered very little inconvenience from the treatment, and only wore the splint for a period of about six weeks, as the cuspid was retained in position by the lower first bicuspid and cuspid. About seven months after the operation the tooth was examined and found to be satisfactory in very way.

In a case of this description surgical treatment seems to be ideal, as the patient is put to so little inconvenience, but one must always bear in mind the risks run in undertaking the surgical treatment of such a case.

Regarding Dr. Waugh's remarks, I should like to say that in cases of fractured mandible, in which a double splint was to be made, I have always used an articulator on which to mount my models before fixing the splints together. In all cases after the removal of the splint I have found the teeth occlude pretty satisfactorily, especially after a day or so, when the jaw has become used to moving once more. I have often used such a splint as mentioned by Dr. Rogers, in which a stiff wire is bent up around the teeth, and then wired in position with ligatures passed between all the teeth; but I have only used a splint of this description in those cases where I considered only a single splint necessary. However, in a case where resection of the mandible is proposed, I should think that a wire splint could be made for each jaw before the operation and firmly wired in place; then, after the operation is performed, the teeth could gradually be brought into occlusion before the new bone is formed, by passing ligatures between the upper and lower splints and exerting gradual pressure. In this way the muscles would be gradually stretched, and it would not be necessary to exert that great stress which is necessary when the teeth are brought into occlusion at the time of the operation.

Dr. Weston A. Price, Cleveland. Mr. President and gentlemen of the American Society of Orthodontists: I feel I am unworthy of taking your time, not being a member of your Society, although I think a great deal of you as individuals. I want to congratulate Dr. Babcock on this operation which he has suggested, and I am sure the work he is doing and that you are doing is going to be of tremendous importance to the coming generation. I want each one of you to feel you are a millionaire in opportunity; that you have a greater opportunity to bless the world than we, who do a general practice, and I say Godspeed to this Society. To my mind it is fitting you should have the cream of all of our profession, because you have the ideal specialty, and I congratulate you in that work.

If I were to discuss the splendid presentation, I would emphasize what someone has already suggested—the making of a cast interdental splint. I may refer to that when I give my clinic this afternoon, showing technique.

Dr. G. F. Woodbury, Cleveland. I did not come to this meeting expecting to be called on for any remarks. I am just here to learn. However, since the privilege has been given me, I will say that while I do not practice this work as a specialty myself, I keep in close touch with the wonderful things you are doing. And I feel as Dr. Price has just suggested, that the field that you are working in and the things you are accomplishing are very great; and the benefits which will result to the people are very large, indeed.

Dr. Robert Dunn. I would like to ask Dr. Babcock a question relative to the bridging over of the periosteum. Orthodontists are frequently required to correct cases of malocclusion where the operation for cleft palate has already been performed and there has been a failure in getting union in the anterior portion of the cleft. In the operation that follows there may be some opening of the cleft. Does Dr. Babcock consider that bridging the gap with a flap of periosteum would result in a restoration of bony union.

Dr. Varney Barnes. Just a little point as to the making of the splints. I have had some experience in swedging them from thin metal, and then soldering the different parts together. My method was to swedge on zinc dies with lead counter. Take the cast and press the model into molding sand and withdraw it. The withdrawal takes away part of the sand where the undercuts were. Then brush or blow off the particles broken away, and press the model back into place and withdraw it, repeating two or three times, thus destroying the pull of the undercuts. I allowed the splint to pass over the gums, flanging outward, and in setting the appliance I use Ames' oxy-phosphate of copper with a large excess, which is allowed to flow down thoroughly between the teeth and on to the gums. No inflammation of the gums ensued, such as you might fear.

Dr. Ernest Walker. As Dr. Babcock is a physician, I would like to avail myself of this opportunity of securing an expression of his opinion on the question of the possibility of a systemic effect on the patient from the use of German silver in these splints. I am using German silver in some mouths, in some, precious metals, and in some, a combination. I use the precious metals for two reasons: Because of its greater durability and greater elasticity after being soldered, and for esthetic reasons; but I have never seen any deleterious systemic effect from German silver. Some have thought there might be such an effect, and the Doctor, as a physician, may probably give us some light on that subject.

Dr. Fisher. I should like to ask if I understood Dr. Barnes that his splints for the superior and the inferior maxilla are united into one piece before cementing.

Dr. Barnes. I do not solder the two splints together; they should be made separately and then wired together from lug to lug.

Dr. Ottolengui. Have you tried wiring the splints together, and seen the result?

Dr. Barnes. Yes, I have.

Dr. Ottolengui. Was it a good result?

Dr. Barnes. It was.

Dr. Fisher. I want to point out the great danger which may result from such practise. Almost always the operation preceding the placing of these splints requires a general anesthetic, and ether is usually selected. Any time during the following forty-eight hours severe vomiting may occur, and if the nurse be away from the bedside at this critical moment your patient will choke to death; or, if the nurse has not sufficient skill, or has not been carefully instructed, she may find it impossible to remove the splint even if she be present at the time of vomiting. Dr. Ottolengui has shown you that cementation of the splint is not necessary, so why take this unwarranted risk with the life of your patient?

Dr. Waugh. I have, on occasion, made and set splints for general practitioners in surgery, and they have never had a satisfactory result, simply because they could not handle the splints. I have never found it of advantage to cement the splint. Our splints are made to be removed for cleansing purposes, etc. I know of one or two cases where the splints were handled by general practitioners, and they went against my instructions regarding removal for cleansing, and they were compelled to take the splints out because the tongue became swollen and sore, and the physician feared the life of the patient might be endangered.

Dr. Casto. Dr. Babcock's paper has been of much interest to me. The work he has done and is doing now deserves very great consideration. It is a phase of surgery that has been neglected.

A few weeks ago I had occasion to witness an unusual operation on the mandible. It was of especial interest in that it demonstrated the great power of nature to heal. The history of the case was as follows: The patient, a man forty-one years of age, was driving home in the country with a team of horses and a heavy wagon He was intoxicated; the horses became frightened and ran away; the man was thrown from the wagon and was either run over by the wheels of the wagon or kicked in the face by the horses. At any rate, when he was brought into the hospital he was in a very bad condition. He had several broken bones and many cuts and bruises. His lower jaw was fractured in three places: (*a*) through the ramus on the left side, about half way between the condyle and angle; (*b*) through the body of the jaw in the region of the lower left bicuspids; (*c*) and through the body of the jaw in the region of the lower right bicuspids; on this side there was considerable contusion of the soft tissues and bones, and one or two of the teeth had been knocked out. The lower lip was badly contused and part of it had been lost.

When the patient was brought to the hospital, the surgeon on the case found him in such bad condition that after doing everything he thought necessary to save his life, he decided it was not best to do very much work on the face and jaw. He did, however, operate on the fracture of the body of the jaw on the left side. He wired the bone together, and it united perfectly; he also closed the gap in the lower lip. A portion of the lip had to be removed, so that when the cicatrix formed the mouth was very much constricted. The fracture of the ramus on the left side and the fracture of the body on the right side were not operated upon at that time.

About six weeks after the first operation I was called into consultation on the case. I found the following condition: The patient had no use of the lower jaw. The mouth was in a most unhygienic state. There was considerable contused tissue around the fracture of the body on the right side and evidences of necrosed bone. The teeth in close proximity were quite loose. At the fracture of the ramus the lower part had been forced back and up beyond the upper part and was held securely by the muscles and the formation of new tissue. There was absolutely no chance to use a dental splint or apparatus of any kind, therefore a radical operation was advised.

The patient was anesthetized with ether by the Crile method, *i. e.*, by passing rubber tubes through the nares to the larynx, the other end of the tubes being attached to the ether bottle.

The fracture of the ramus was operated on first. An incision about three inches long was made under and along the ramus and angle of the jaw. It was with considerable difficulty that the ends of the bones were exposed, a cartilaginous tissue having formed which had to be removed.

The ends of the bones were made fresh by scraping, and then put into adaptation. Holes were drilled through the bone on either side of the fracture and a steel staple was driven in. Silver wires were passed around each segment and the staple to assist in holding it in place. The fracture of the body on the right side was then operated on. The constriction of the mouth, caused by the loss of tissue and cicatrix, made it necessary to make an incision. An incision was made beginning at the angle of the mouth and ending at the lower border of the chin. Considerable necrosed tissue was found that had to be removed. Two teeth also had to be removed. The ends of the bones were scraped until healthy tissue was reached; a hole was drilled through each segment of the bone near the fracture and a good-sized ordinary steel screw put in. A silver wire about 26 gauge was then wrapped around the heads of the screws in a figure of eight style, bringing the ends of the bones into adaptation.

On account of the loss of bone the jaw was drawn over to one side and a considerable deformity produced. There was practically no occlusion of the teeth.

The operation lasted about two hours. The patient was an alcoholic, and got in such bad shape during the operation, I did not think he would survive it. He did, however, and the surgeon advised me yesterday that he had been discharged from the hospital several days ago in fairly good physical condition.

Dr. Babcock. I beg to thank the gentlemen for the many valuable suggestions they have made. I realize that this subject is a rather young one and undeveloped, as has been said. We are simply feeling our way along. The men of this Society will contribute a very valuable part to the advances which will be made. I think the surgeon is a sort of handmaid to the orthodontist in this work. It is usually for the orthodontist to say whether the operation shall be done, or whether it is necessary. If the orthodontist advises the patient, that settles the matter at once. Even though the surgeon does the work, he must have the assistance of the trained orthodontist to keep the parts in position, make the splints, etc. Then, afterward, there will usually be some deformity requiring correction. The surgeon can often only hew out the rough part of it; the result may be so good the patient will be entirely satisfied; or often orthodontic work must be done. I neglected to thank the dentists who have helped me: Dr. S. H. Guilford, Dr. Thomas Weeks, Dr. Merrill Weeks, and others. I am indebted to them for suggestions and for aid in the work.

I can heartily agree with what has been said as to the limitations of surgery and of orthodontia.

I was very glad the Gigley saw, as used by Dr. Blair, was mentioned. That is a very ingenious way of using it. In my operations it was my desire to see the ramus. I wished to see how the fragments looked after the reduction, and I wished to use wedges also. Both of the incisions in these cases showed us the ramus.

In regard to the soft tissues, there is no trouble in that respect. If the manipulation has not been too severe, if the soft tissues are not traumatized too much and you do not devitalize the tissues and are clean in your work, you will have no trouble. An aseptic union should be the usual result. We use buried sutures for the skin, so as not to leave suture holes.

As to the use of auxiliary devices to bring the jaws together, or the use of splints, this is very important. It is very different from the problem in the case of fractures. In fracture cases you put the bones together in a position which is normal, and the muscular pull is not a very great factor; slight pressure is sufficient.

In the second case it required nearly all the pressure I could muster against the point of the chin to bring the parts into their proper position; perhaps forty to sixty pounds were used.

The object of making two splints is to get a firm hold on the teeth and then wire these at a later time and gradually bring the jaws together. You could hardly hold the jaws in apposition while the cement hardened. The principle that I mention of dividing the ligaments should enable one to mobilize the jaws so that this pressure will not be required, and then of course the problem is simpler.

In one case we used a plaster of Paris bandage around the head, and could not get it tight enough to hold the teeth together. It was insufficient. You must have adequate and continuous pressure. If you have your caps fitted and wired around the necks of teeth and cemented also in advance of the operation, then, even although you can not bring the jaws together as you wish, because of the size of the tongue, you can partially bring the jaws together, and later on bring them into occlusion, taking two or three days, and avoiding tremendous immediate pressure and the danger of suffocation. In one case we used elastic bands to keep up continuous pressure, and it required about a week before the patient could keep the tongue back in the mouth. In the second case the cavity of the mouth was very small, but after a few days the tongue accustomed itself to the new conditions, and the teeth could then be put in occlusion.

The first splint pulled off the teeth; it had been cemented on. Even this was insufficient. We found, too, as Dr. Ottolengui has shown, that we were keeping the teeth too far apart, so Dr. Thos. Weeks ground off the cusps so that we could see the positions of the teeth and note how the occlusion was when the caps were put back a second time.

There is no doubt but it is desirable to make the splints in two portions, and it is desirable to put them on before you do the operation. It sometimes requires anesthesia to bring the jaws together after the operation. If bands or wire ligatures are used you can gradually bring the teeth into occlusion without the necessity of anesthesia. It simplifies your after-procedure very much, and sometimes you can at once put the jaws in occlusion. In regard to the anesthetic, if the patient is fairly old, use apomorphia. It is not so useful in young patients. The patient awakens without any knowledge that the operation has taken place. It leaves the mouth dry and there is no vomiting afterward. Ether may be used by the metheds described, or by the rectal methed. Or, one can use nitrous oxide, with the nasal inhaler.

Dr. Casto. Would you call that rectal anesthesia, and how long has it been used?

Dr. Babcock. Ether was first used in 1846 and 1847. Within a year a noted German surgeon had advised giving it by rectum. It rarely was used in that way however, until forty years later, and in the eighties one of the New York surgeons started to use it with at first splendid results. Dysentery followed its use, and it again fell in disfavor. Ten years afterward it was revived in Boston. The older surgeons used it without proper methods of ventilation and in too concentrated a form; now it is used with but slight trouble. It is a method of some value in these operations on the face.

In their operations on the jaw I think it criminal for surgeons simply to leave the fragments of the jaw unsupported, and not securing the aid of the dentist or orthodontist to fix the fragments in place. Possibly a tumor is excised and the teeth are left in malocclusion, and the jaw is of no use to the patient whatever. If the fragments were only left in occlusion, later on when the tissues had united there would have been secured a jaw of some value. This was one of the crimes frequently committed in surgical practice in the past.

I do not think that even cement is sufficient in some of these cases. You must have wire ligatures to give proper anchorage for the splints.

Replying to Dr. Walker I would say that the systemic effect of German silver is inconsequential, I think. I believe it may be entirely disregarded.

Answering Dr. Dennis' question, unfortunately the periosteum of the superior maxillary bone has not the regenerating power of the inferior maxillary. In the roof of the mouth we have only periosteum and mucous membrane—practically one membrane, but if you separate them and preserve the under layers of the periosteum you can obtain some bone formation on the under side of it.

Dr. Dunn. Could you bridge over the soft tissues by using these same methods?

Dr. Babcock. It is easy to strip up the periosteum, but here you have the mucous membrane and periosteum amalgamated and you can not split them apart but must use both. You can not use one without the other very well.

Now as to the sore tongue after these operations, it is necessary to cover the rough points of the splints, etc., with wax or similar materials.

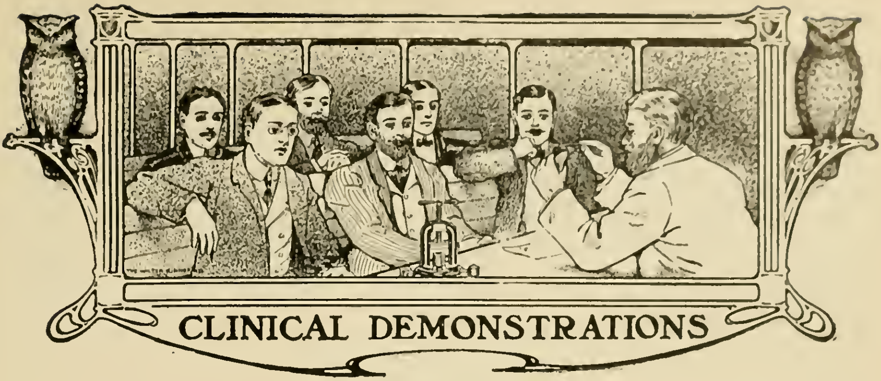
Dr. Waugh. Have you had trouble from the fermentation of food?

Dr. Babcock. Very little. I have used wax and paraffin or other gum around the teeth to cover all the depressions and gaps.

Dr. Waugh. You can open the mouth?

Dr. Babcock. No, the teeth must remain in occlusion.

As for the open operation of the wiring of fractures of the jaw is very rarely necessary, I think. In my experience I have felt when I went in from below, through the face, and have wired the fragments together, we have done more harm than good, and have simply opened up tissues partly devitalized, and traumatized them more than before, and there is usually more suppuration, irritation and necrosis of bone than would otherwise occur. The dentist or orthodontist is a better man to treat fractures than the operative surgeon. The surgeon who is safest, in other words, is the man who uses dental methods. The Hammond splint works very well. The open operations on the jaws I think usually do more harm than good.



CLINICAL DEMONSTRATIONS

Clinics before the American Society of Othodontists.

A Retainer

By Howard D. Keeler
Des Moines, Iowa

A new method on attaching a lingual arch bar to bands on teeth designed to hold and support same. It is my opinion that a retaining appliance, which is not rigid, and one which will do what is required of it, is far better than an appliance which is essentially rigid, that is, with soldered attachments of bars to bands. In this appliance the connection between lingual arch bar and bands is made by means of tubes (very small) placed on arch and soldered to bands which are to support the same. This makes of each attachment a hinge joint instead of a soldered rigid connection.

Bands of 22 k. gold, 36 gauge (or of platinum) are made for such teeth as are selected to hold the retaining bar. These bands are placed in position of the teeth and the impression taken. Remove bands and place carefully and accurately in impression and fill with investment material; separate and you have model with bands in their relative position.

Select a lingual arch bar, usually iridio-platinum wire, number 18 gauge, and make tubes that will fit. Make tubes in following manner. Take piece of 22 k. 36 gauge gold and cut strip about one tenth of an inch wide. This will be length of tube. If you wish tube longer or shorter cut strip accordingly. Anneal well and roll on the iridio-platinum bar, which will make the tube. Two or three times around is sufficient for strength. Remove from bar and flow in a little 20 k. solder, taking care that the solder does not flow within the tube. Make as many tubes as you may wish for your case in hand.

In making an elaborate retainer, such as is shown in Fig. 1, bend bar to fit case, placing a tube opposite or against each band and solder tube to band, taking care again that the solder does not flow within the tube, which would make a rigid joint. Paint surface of bar within the tube with whiting or rouge to avoid this. Solder tubes to band with 18 k. solder. If bar extends back to molar, make rigid attachment at that point. I make many of these with but two attachments, that is, on both cuspids.

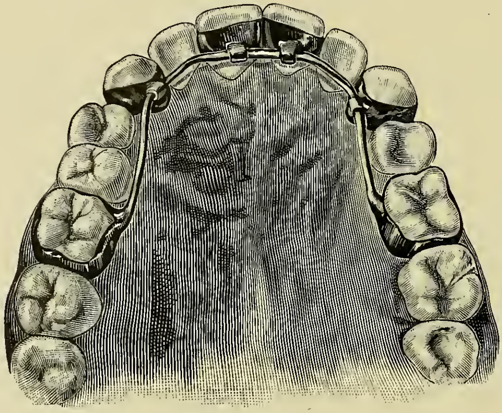


FIG. 1.

If arch has been expanded and anterior teeth moved mesially, this retainer is sufficient. In these cases there must be quite an angle (as near as possible to right angle) in arch bars at region of cuspids and tubes placed exactly in the angle, else there will be some slipping distally as there would be no attachment to molar bands, the lingual bar extending distally only as far as second bicuspid.

There are two features about this retainer that I wish to bring out. First, ease with which it can be inserted, especially as it is indicated where there is much or great diverging of the cuspids. Over some of the cases of slanting cuspids it is almost impossible to place a rigid retainer. Second, with the hinge joints, the apices of roots, instead of being immovably held by a rigid retainer, are permitted to work forward. In many cases there is much inclination of roots, and we want a retainer that will allow these teeth to "straighten up," under lip pressure.

Working Retainer;
Skeleton Bite Plane;
Elevating Bicuspids;

By J. Lowe Young
New York

Figure 1 shows what I have termed a "working retainer," owing to the fact that the point of contact on the lingual surface of the upper front teeth is so high that the constant pressure of the lower lip on the incisal third of the labial surface will act as a lever and cause the apices of the roots to move forward stimulating bone development.

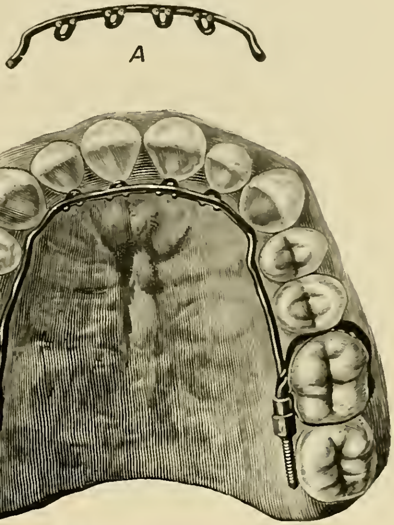


FIG. 1.

This form or retainer has proved very valuable in cases where there is pronounced lack of bone development in the upper incisor region. It is also inconspicuous.

The lingual wire is of iridio-platinum, nineteen gauge, while the small U's shown at A are of iridio-platinum, twenty-five gauge, soldered to the base wire with pure gold.

It is very necessary that these U's be made of light wire so that they may pass well up under the gum without causing irritation, and also, that if found necessary they can be readily bent for any final adjustment without disturbing the base wire.

Figure 2 shows the skelton bite plane which has proved of value in the retention of Class II, both first and second divisions, where the molars and bicuspids are in infra-occlusion. The soft tissues under such a bite plane are far less liable to become inflamed and hypertrophied than when a solid bite plane is used.

In the construction of this retainer the lingual base wire is fitted first and then the other piece bent to fit approximately and one end soldered to the lingual wire with pure gold. The next contract point can be made to rest tight on the lingual wire and soldered and so on throughout.

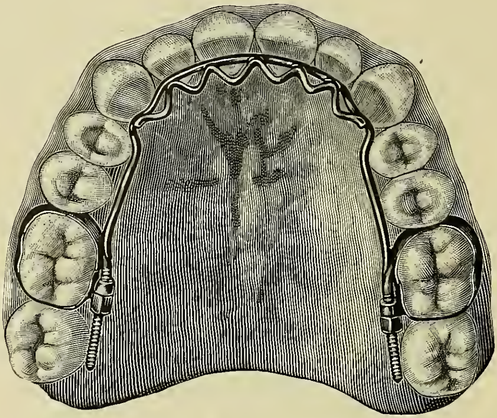


Fig. 2.

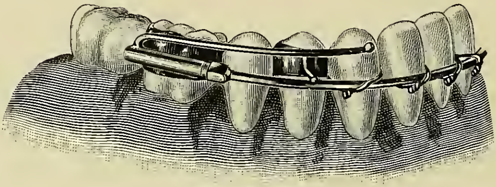


FIG. 3.

Figure 3 shows an auxiliary spring of clasp-gold soldered to the buccal tube of a clamp band and extending forward to the cuspid region. This has proved a very satisfactory method of elevating the bicuspids and cuspids in cases of infra-occlusion. The teeth to be elongated should be fitted with plain bands having a spur that the wire may be sprung over or ligated to them, as desired. The arch which is ligated to the anterior teeth prevents the tipping of the molar during the use of such a lever.

Extension Tooth Movement,
Split Tube Attachment,
Lingual Attachment for Clamp Bands,
By C. A. Hawley,
Washington, D. C.

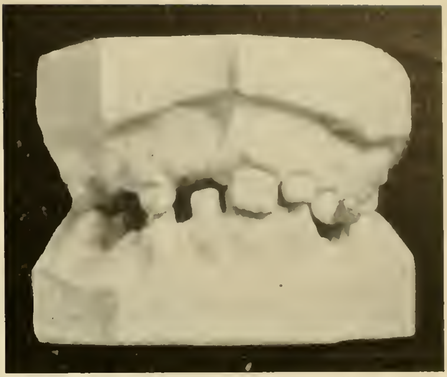
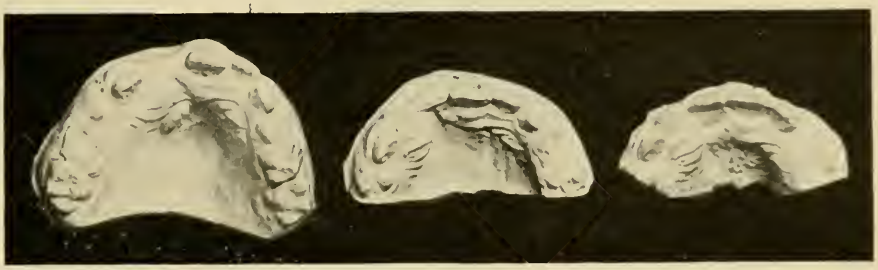


FIG. 1.

Understanding that there is considerable interest just now in the question of how far, and under what conditions a tooth may be moved without danger of death to the pulp, I brought with me some slides of a case that is interesting from that standpoint. The first (Fig. 1.) shows the appearance of the teeth of a nine-year-old boy from the labial aspect. The next (Fig. 2) study models of the occlusal aspect of the teeth at the beginning of treatment, at the stage when the labial movement was accomplished, and at the conclusion.



(*a*) (*b*) (*c*)

FIG. 2.

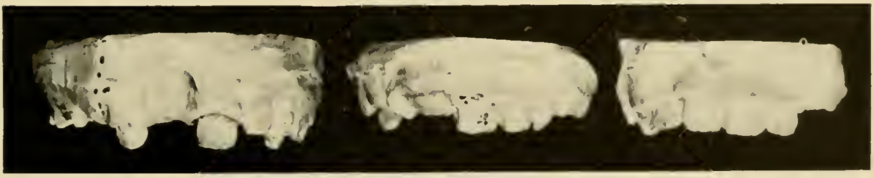


FIG. 3.

The right central incisor had erupted nearly in the center of the palate, about on a line across the first bicuspids (*a*). It was drawn labially to the line of occlusion and rotated, its incisal edge at that time being about level with the gums (*b*). It was then removed down to the same degree of eruption as the other central (*c*). The last movement is shown in (Fig. 3). It was then retained in position and at the end of three months, there having been no evidence of pulp disturbance an X-ray photograph was taken (Fig. 4) which indicates a fully formed root and healthy pulp.

Figure 5 shows a modification or development of the square tube device first described by Dr. Kemple, the modification being suggested to me by Dr. Abell. This modification consists in the use of a round split buccal tube, the split portion of which engages with a lug of plate or wire soldered on the expansion arch, thus preventing the expansion arch from turning in the tube, and consequently providing for the bodily movement of the molar used as anchorage. It appears to me that this device is just as effectual as, and easier of adjustment than, the square tubes used for the same purpose.

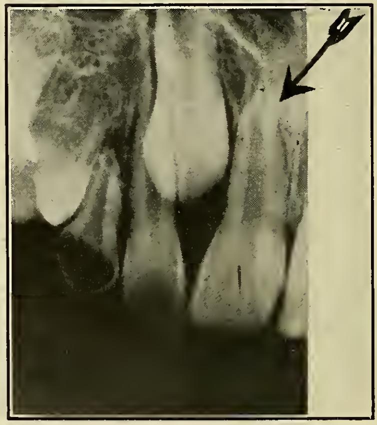


Fig. 4.

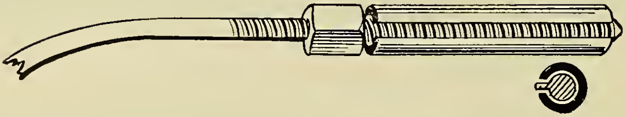


Fig. 5.

Figure 6 illustrates a combination of my own for obviating the necessity of ligating the bicuspids during the first stage of treatment at least, and for adding stability to the expansion arch so that it will not need as frequent attention as in the usual method of ligating all of the bicuspids to the expansion arch. This combination consists in the use of a lingual wire extending from the mesial angle of the molar clamp band to the distal angle of the cuspid on each side, the bicuspids being banded with lingual hooks engaging with the lingual wire, and with buccal eyelets attached to the bands in the buccal embrasure for engaging the ligatures from the expansion arch. The lingual wire may be extended to the mesial angle of the cuspid which is banded in a similar manner when the indications of treatment warrant it.

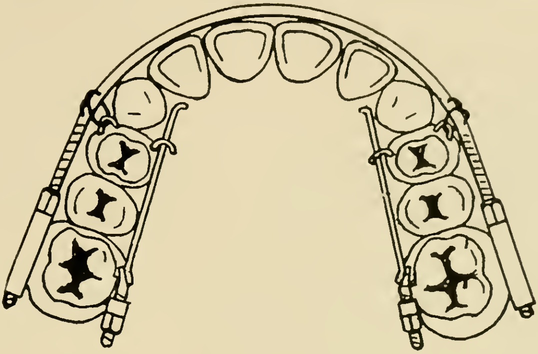


FIG. 6

The advantage of the arrangement is that, during the first stage of treatment while the arches are being widened, there are no ligatures required back of the cuspids. The lingual wire carries out the bicuspids and cuspids or in young cases the temporary molars and cuspids without the irritation of ligatures around the teeth. The short one from the little loop to the arch is not likely to get loose. I have had some cases go over the summer without any attention and nothing got out of place.

Widening the Molar Region,

By Rodrigues Ottolengui,
New York.

In widening the molar region, using the expansion arch, it has often been noted that there is danger of tipping the molar crowns buccally. This will either "open the bite" or throw the tipped tooth out of occlusion. The exception would be where the molar at the outset might be tipped abnormally toward the tongue, in which cases the "bite" is commonly too close, a fact easily proven by observing that the overbite in the incisive region is too long. In such cases by tipping the molar buccally the tooth is lifted into an erect position, and brought into normal occlusal relations, while coincidentally the too long overbite is corrected.

Thus it is seen that at times it is desirable, and at other times undesirable, that molars should be tipped during the process of moving them buccally. Such tipping depends wholly upon the opportunity for the metal arch to turn in the buccal tubes, and to prevent or modify this possible turning several orthodontists have devised various mechanisms.

Perhaps the most efficient heretofore suggested, has been the square tube presented to the profession by Dr. Fred. C. Kemple. In this apparatus the buccal tube is square instead of round, and a second, smaller square tube is soldered at the extreme end of the arch. This smaller tube is made to exactly telescope the larger buccal tube, and by preventing rotation of the arch within the tube, modifies the buccal movement of the molar, practically preventing tipping, and thus compelling the bodily transit of the tooth. A molar treated in this manner offers greater resistance to stress, than where the round tube is used, and consequently the square tube offers an excellent anchorage where the molar on one side alone is to be carried buccally. In such cases the square tube may be placed on the tooth which is already in normal or nearly normal pose, while a round tube may be used on the opposite side where the tooth may be in lingual occlusion.

I have had excellent results with the Kemple square tubes, and am still using them where I know at the outset that the molars should be moved little or not at all. But occasions arise where we wish to move the molars somewhat, and will then desire to prevent or control further buccal movement or tipping. And for this purpose I am pleased to present a device which is but a slight modification of one shown to me by Dr. Hawley.

Dr. Hawley used a round buccal tube and this tube was split throughout. To the arch he soldered a short lug, which, sliding in this split tube would somewhat prevent rotation of the arch in the tube. I can not see any advantage in this appliance over the Kemple tubes, and indeed I do not believe that it prevents rotation to the same extent as does the square tube. Moreover, the Kemple tubes seem to me more easily adjusted. However, the Hawley appliance suggested to me the following:

Figure 1, in the the larger drawing, shows the complete appliance in place. The split in the tube is here seen to be presenting toward the morsal ends of the teeth; but this is done solely for the purpose of illustrating it. In practice I prefer to attach the tubes so that the split presents rootwise.

The usual arch (a) is used. The buccal tube (*b*) is round and has a split throughout its complete length. Over the end of the arch I use a smaller tube (*c*) which exactly telescopes the larger buccal tube, and to which is attached a round wire lug wich engages and slides in the slot in the split tube. This small tube (*c*) is threaded so as to screw on to the end of the arch. This affords several advantages. It allows of its use without being soldered, and when the telescoping tube is not soldered it serves as a friction collar to steady the arch in the tube while at the same time permitting rotation of the arch within the tube. Thus, when the telescoping tube is not soldered to the arch, the molar may be tipped outwardly. When it is soldered, rotation of the arch within the tube is to an extent prevented and the device operates on the same principle as the Kemple square tube. At (*e*) we see the telescoping tube and lug screwed on to the arch, and at (*f*) we see the same, with tube and nut in place. The nut (*d*) has one-half of its extent left round. In use it is not so convenient as the square nuts, but it resists the action of the cheek and tongue to turn it.

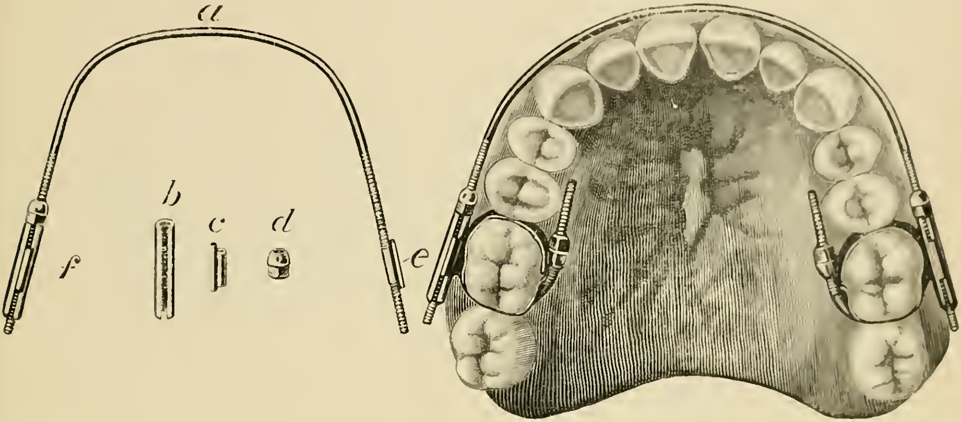


FIG. 1.

The advantage of this device (if there is any) is to be found in the fact that the appliance may be operated either as an ordinary round buccal tube, or on the principle of the Kemple square tube. Thus a case requiring widening in the molar region may be started with the telescoping tube (*c*) simply screwed on the arch. As soon as the desired width across the molar region has been obtained a tiny bit of soft solder firmly attaches the lug to the arch, and thenceforth we have the action of a square tube. It may happen that one molar may move more rapidly than its fellow on the opposite side. In such case one telescoping tube (*c*) may be soldered to the arch and the other left loose till the other molar is in the position desired.

The Northcroft Plaster Plane

By Dr. Hedley C. Visick
London, England

This plane is designed to be a time-saver to the orthodontist. With it a pair of models may be trimmed up by a novice in about one third the time usually required.

The apparatus which is here shown consists of a scribing-tool, an adjustable rubber-padded tripod, a shooting-board, a bronze plane, and a piece of plate glass.

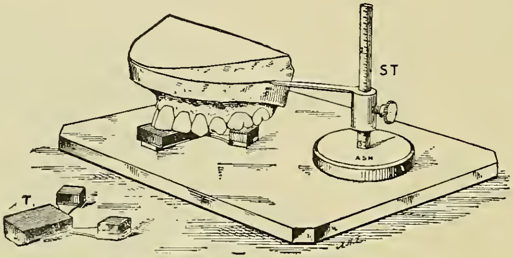


Fig. 1.

S T—Scribing-tool. T—Tripod with Adjustable Rubber Pads.

1. The scribing-tool, instead of being made, as is usual, of steel, is made of brass, nickel-plated, to prevent rusting, and is marked on the scale in one-sixteenths of an inch (of course millimeters could be used equally well), the scale starting from the same level as the upper surface of the rubber pads on the tripod.

2. The tripod has adjustable rubber pads attached to it to prevent damage to the plaster teeth, and is calculated to support any model, from the smallest to the largest.

3. The shooting-board is designed with an adjustable angle-piece, with which to produce the two planes that are at 135 degrees to the back; also, with a step to facilitate the cutting of the angles without injury to prominent teeth..

4. The plane is a modified "jointer plane," mode of gunmetal or bronze to prevent rusting, the blade being phosphor-bronze, which is especially tough.

5. Plate glass is used to facilitate the use of the scribing-tool in combination with the adjustable tripod, but any really flat surface does equally well. The glass is not supplied with the outfit.

Their method of use is, briefly, as follows:—

The model having been cast and separated, the "natural" portion at its greatest depth (say from the tip of the canine to the bottom of the sulcus above the canine fossa) is measured off on the upright bar of the scribing-tool, to which a third of this depth is added; then the whole distance is marked off from the base of the tool by the adjustable pointer.

The model is now inverted on the tripod, and so arranged that the two first molars, or second temporary molars, if the permanent teeth have not erupted, and the centrals only, are touching the rubber pads; a line at the height indicated by the pointer of the scribing-tool is then scribed round the base of the model, to which line the base is cut away by the plane, the back edge having been previously made moderately straight to enable the model to be held firmly on the bench or board.

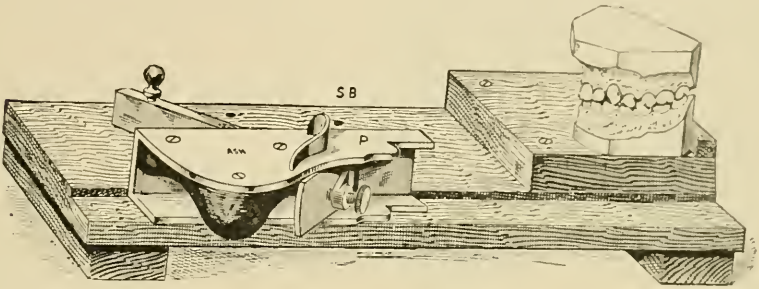


Fig. B.

S B—Shooting-board P—Plane.

Having obtained a smooth base, the model is placed on the shooting-board. First the back edge is cut at right angles to the median line. Then the back corners are cut off at angles of 135 degrees to the back, as indicated by the movable angle-piece on the shooting-board, so that the back surface of the model terminates on either side at a point opposite the median sulcus of the last tooth—in other words, at a point which should correspond with the buccal cusps of the lower teeth. Then the sides are cut parallel to the molars and premolars on either side, up to a point opposite the middle of the cuspids; from that point the model is cut forward on both sides to a point opposite the median line.

The same method is adopted with the lower model, except that the front is cut on a curve from cuspid to cuspid, the back finishing on either side in line with the buccal cusps of the lower molars.

The Square Buccal Tube*

By F. C. Kemple, D.D.S.

New York

Fig. 1 illustrates the telescoping square tubes which were referred to by Dr. Ottolengui and Dr. Hawley. The technique of adjustment is very simple, and the principle of its application in connection with the "expansion arch" is very broad.

c Shows the buccal tube which, if such a term may be used, has a square "bore" into which the smaller square tube *b* exactly telescopes. *a* shows a small reducer which, used on the engine, strips the thread from the end of the arch and reduces it to exactly fit the opening of the small tube *b*. When the appliance is adjusted, the small tube being soldered to the end of the arch to prevent the arch from turning inside the buccal tube, the tendency is to carry the molars buccally without tipping them. The degree of tipping depends upon the twisting spring of the arch; therefore, to reduce the tipping to the minimum, a large rigid expansion arch may be used.

This principle of establishing a nearly stationary anchorage in expanding the dental arch offers an efficient means of controlling the force employed in a variety of tooth movements. For example, if it is desirable not to disturb the relation of the teeth on one side of the arch and to perform a considerable movement on the opposite side, it may be accomplished by uniting a series of bands and securely cementing them to the teeth, as shown at *c*. (In such an anchorage the buccal tube should be attached at a point that would equalize the resistance of the two ends of the anchorage.) With the regular round tube on the opposite side, and extension spurs on the lingual side of the bicuspids and molar (*f*) force may be applied without fear of disturbing the anchorage at *e*. With the principle of preventing the buccal tube from turning on the arch a range of resistance may be secured in anchorage that enables one to almost perfectly control the force applied.

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*Shown at Washington, D. C., November, 1908.

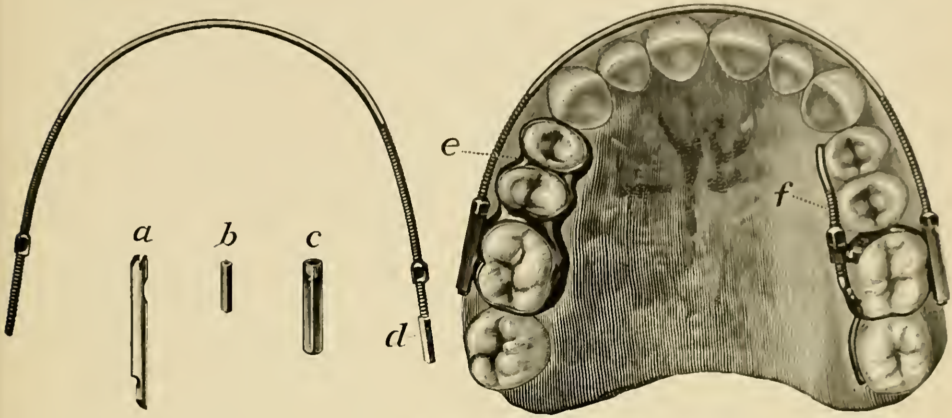

FIG. 1.

Parallel Tube Anchorage Appliance*

Dr. Varney E. Barnes
Cleveland, Ohio

A device to prevent buccal tilting of crowns and to permit or cause root movement, and to increase strength of anchorage.

A. Power tube, with rounded closed distal end to protect cheek, carrying tube nut (B) and soldered to molar or other anchor band.

B. Nut tube screwing into power tube (A) and holding end of threadless arch (D).

C. Tube closely fitting arch wire (D) and tin soldered to it (D) and hard soldered to wire (D′). This tube is not necessary if the arches are of clasp gold or iridio-platinum, as the wire (D′) can then be soldered directly to (D).

D. Threadless arch—usually 16 gauge—may be of any desired metal, and the full strength of wire is at command of operator. (A threaded arch may be used if desired.)

D′. Supplementary wire sliding closely in tube (A′) and by its soldered attachment maintained (D) in whatever position desired, providing it keeps a parallel with (D). This wire sliding in its tube prevents tilting or permits of root movement according to its radial relation with (D), and at the same time gives the arch all the advantages of forward movement controlled by a screw. This wire is usually 18-gauge, or may be smaller. The loop is for the manipulation of the nut with a wrench. It will be noted that this loop travels with the head of the nut.

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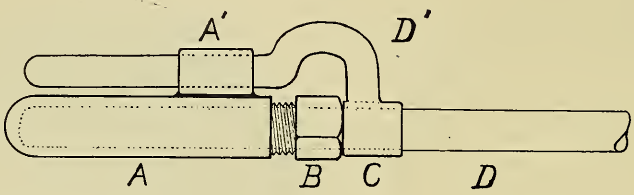
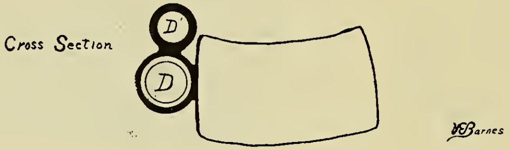
*Shown at Washington, D. C., November, 1908.





A′. Supplementary tube soldered parallel to tube (A) and as close to gum as is possible. This tube transmits the torsion pressure from D to C to D′ to A′ to A to B to D, completing the circle and preventing any horizontal or other hinge action.

Method of Shifting Teeth around an Arch.

Dr. Varney E. Barnes.
Cleveland, Ohio

A. Power tube, with rounded and closed end to protect cheek, carrying nut tube C and soldered to band F. (A horizontal hinge attachment.)

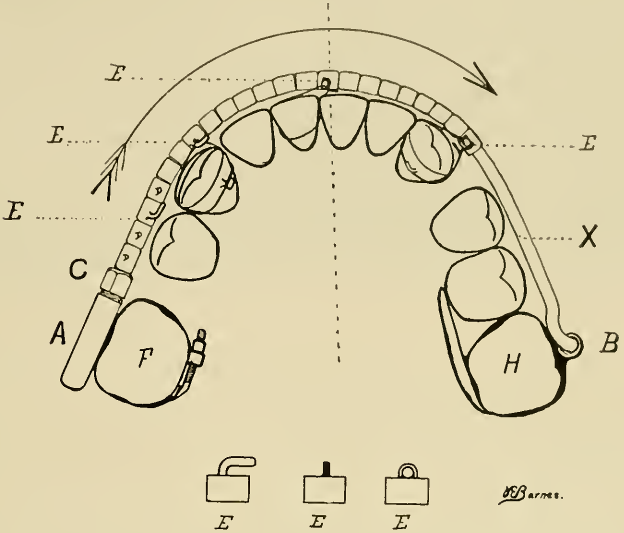
B. Vertical tube attachment (Ainsworth) providing an attachment for end of arch (X) with vertical hinge effect and greater buccal anchorage.

C. Nut tube screwing into power tube (A) and carrying one end of 18-gauge threadless arch (X), which simply slips into the inner threadless tube of the nut.

D. D, D, D, etc., are short sections of tube 1-16 to 3-32 inch long, which fit easily over 18-gauge arch (X). These tubes travel *around the arch* or away from the point of tension which is at the head of nut (C) when the nut is unscrewed out of tube (A).

E. Sections of tubes D, D, D, to which are soldered any kind of attachment desired—in this illustration hooks and rings are used.

F. Screw clamp band with flap. Flap providing means for a closed band in all sizes and preventing washing out of cement and thereby preventing decay where it often occurs with ordinary clamp bands.



H. Plain cemented band with lingual bar to increase anchorage strength. The bands (F) and (H) are shown to outline possibilities in the device. Any type band may be used at either anchorage as the case may demand.

In action ligatures are attached to attachment tubes E, E, E, E, to the teeth to be shifted and the nut (C) is unscrewed, moving tubes D, D, D forward and traveling along the arch with no more than a little friction on that arch. The teeth attached to the tubes, therefore, travel or shift around the arch, or along it at any point desired, depending only on the number of tubes.

Power nut tubes as A-C may be attached at both anchorages and the sliding tubes used to shift cuspids and bicuspids forward in a positive manner and up to the position of incisors which may have previously been moved forward. The incisors may be ligated to the arch, which remains stationary, while the cuspids and bicuspids are brought forward.

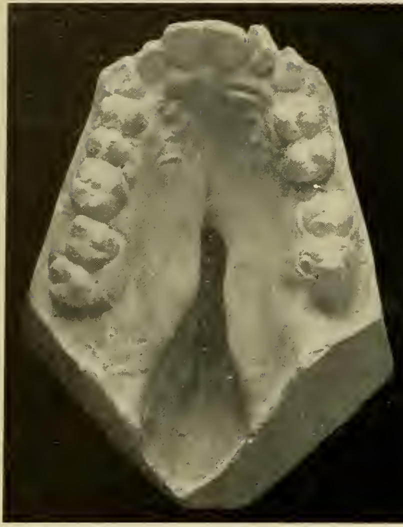


FIG. 1.

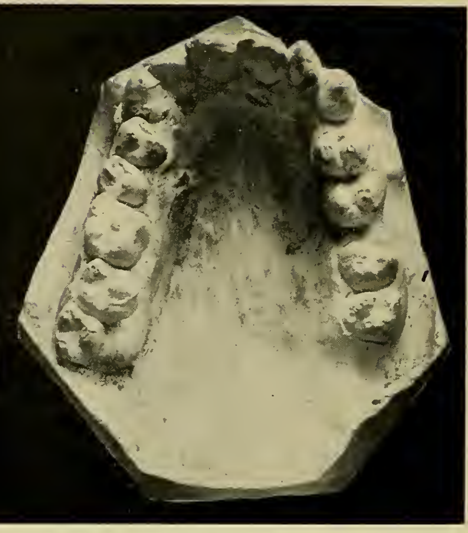


FIG. 2.

Surgical Treatment of Cleft Palate

By Dr. C. T. Lyons
Jackson, Mich.

The subject of clinic was "Surgical Treatment of Cleft Palate." Exhibited models before and after treatment, also exhibited patient who had been operated on.

Age of patient, 27.

Cleft of soft palate.

Fig. 1 shows model of mouth of patient before operating.

Fig. 2 shows model of mouth four weeks after operating.

Before the operation patient could not pronounce her own name distinctly as her name has the letter "k" in it, involving the sound of hard "g" as in "girl," "give," etc. This sound is a difficult one for one affected with cleft palate to pronounce.

This operation was performed several weeks before the meeting and the patient was able to read and talk plainly, pronouncing her own name as distinctly as anyone.

THE AMERICAN SOCIETY OF ORTHODONTISTS

Serial
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1910

TENTH ANNUAL MEETING HELD AT
DENVER, COLO., JULY 13th,
14th, 15th, NINETEEN HUNDRED TEN

THE AMERICAN SOCIETY OF ORTHODONTISTS

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Dates and Places of Meetings of The American Society of Orthodontists.

First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903; January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30, and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

Ninth Annual Meeting held at Cleveland, Ohio, October 4, 5 and 6, 1909.

Tenth Annual Meeting held at Denver, Colo., July 13, 14 and 15, 1910.

Table of Contents

President's Address

B. Frank Gray, D.D.S. 5

Death of Pulps Due to Tooth Movement

J. P. Buckley, Ph.G., D.D.S. 20

Contribution to the Knowledge of Retention in Class II

Herbert A. Pullen, D.M.D. 44

The Use of the Inclined Planes in the Correction and Retention of Mal-Occlusion

Alfred P. Rogers, D.D.S. 69

A Preliminary Study of the Influence of the Forces of Occlusion on the Development of the Bones of the Skull

Lawrence W. Baker 85

Mal-Formed Bones of the Face As a Cause of Brain Inactivity

G. M. Wright, M.D. 103

The Radiograph in Orthodontia

A. H. Ketcham, D.D.S. 110

Facial Expression from the Point of View of the Artist

Henry Read 145

Tooth Powders—Their Ingredients and Effect on Bacteria

Daniel S. Neuman, M.D. 148

The Movement of Teeth Bodily

Dr. Ray D. Robinson 151

President's Address.

By B. Frank Gray, D.D.S., Los Angeles, Cal.

Your President feels no small degree of pride this morning in addressing this representative Society of Specialists. The honor of having been chosen as your presiding officer for the current year was quite sufficient in itself to gratify any reasonable ambition an orthodontist might have, and I almost feel that I am being additionally honored in that the American Society of Orthodontists has chosen this year to meet in Colorado, the State of my first adoption. However, since I now have my home on the extreme western rim of the Continent I am disposed to share this latter honor with my very dear friend, Doctor Ketcham, and with the other orthodontists of this immediate region.

How many times has it been said that we are living in an age of tremendous progress. Only a little more than fifty years ago one of the most eminent statesmen of our Nation publicly announced in the Halls of Congress his conviction that this immediate country where we are meeting to-day was permanently beyond the confines of civilization; that it was a region infested with wild beasts and savages, and its subjugation and civilization was not to be thought of. Colorado is only thirty-four years old, yet the Indians have been subjugated, and the wild beasts are no longer a menace to our peace of mind. These brief years have been epoch-making ones, and the evidences of progress may be seen on every hand as one visits the beautiful cities of this State and travels through her fertile valleys and plains, or climbs her lofty mountains in

Reprint from Items of Interest

the easy comfort and luxury afforded by the modern railway train. It has occurred to me there is a certain analogy existing between the very environment in which we meet this year and in the beginnings and progress of the specialty which we represent. This great Middle Western country, with its agricultural, mineral, climatic and scenic resources, was no more truly undeveloped or virgin soil a few decades ago than was orthodontia. The vision of the pioneer in the one case, as truly as in the other, has worked out the result thus far.

Doctor Edward H. Angle, to whom this Society owes its inception, has most certainly blazed the way for those who follow after, more clearly than any other man in the history of our profession. I would therefore pause a moment to speak of the honor that is due him. In the essence of the thing it matters little whether certain differences may have arisen between the founder of this Society and men who are contemporary with him. The fact remains that in a wonderful degree to his clear vision is the present status of the specialty of orthodontia due.

Orthodontia of Early Days.

Nor do we forget the eminent services to orthodontia rendered by Doctors Kingsley, Case, Farrar, Guilford, Jackson and a number of contemporaneous workers in this field. Their influence has been a most worthy factor in the development of our science to its present state of efficiency. It has been to me a source of interest and delight to inquire again, and yet again, into the actual beginnings of that part of the practice of dentistry that interests us most as specialists. I am indebted for some interesting data in this latter connection to the admirable *History of Dentistry* so recently compiled and published by Dr. Vincenzo Guerini. Referring to the work of Hippocrates he says: "Toward the commencement of the sixth book (on Epidemics) the following observation is registered: 'Among those individuals whose heads are long shaped, some have thick necks, strong members and bones; others have strongly arched palates, their teeth are disposed irregularly, crowding one on the other, and they are molested by headache and otorrhea.'" Dr. Guerini continues: "While we would be tempted to attribute the knowledge of the relations between malformation of the skull, the palate, and bad arrangement of the teeth to quite modern studies, we are obliged to admit, and to our great surprise, that these relations were already noted, twenty-four centuries back, by the great physician of Cos."

While we have known of Fauchard's interest in the treatment of malocclusion in the eighteenth century, and probably of the work of men who antedated him by many years, I think it is wonderfully interesting to know to what a remote time in the world's history a study of this fascinating subject may lead us.

Again, I have from the same source, a notation with reference to the Book of Bartholomeus Eustachius, published in 1563. From Chapter XXIX: "That teeth are sometimes cut in the palate is a fact attested by Allessandro de Benedetti and others. It has also occurred, within my own experience, to observe this in the person of a Roman woman, who had a tooth in the roof of the routh, near the opening which is in proximity to the incisors, and at Gubbio there is, in the Monastery of the Trinity, a nephew of the distinguished jurisconsul Girolamo Gabriella, who at the age of eighteen cut a tooth in the middle of the palate."

Thus it appears that malocclusion of the teeth, which some of us may have supposed to be either the product of a more modern civilization, or that it was not, at least, observed at a very early period, was in fact noted and commented upon many ages ago. One is almost reminded of the art of printing, and other useful crafts, which flourished, to a degree, in ancient times, but which, subsequently, suffered a long period of stagnation, if not of actual decadence. Happily it has fallen to the lot of this day and age to gather up, in many instances, the tangled skein of the past and press forward to their successful development many of those departments of science which had their inception in times all but prehistoric.

Practical Side of Orthodontia.

There is a practical trend given to the work of the American Society of Orthodontists that has an appeal to the specialist in this department of dentistry. While the theoretical and the truly scientific are in no wise eliminated from our annual program, our Board of Censors makes opportunity each year for an exhibition of clinical methods or procedures that are of great value to the orthodontist. While it is true that the successful correction of malocclusion of the teeth demands an unusual mental equipment,—a broad education, in fact,—it is equally true that the ultimate result in any case is only reached through mechanical means. It is not the part of wisdom, therefore, to disregard that portion of our work which deals with the mechanical methods involved. Consequently, I trust we may welcome the clinic as a permanent feature of our annual meetings.

Extraction No Longer Advocated.

That rapid progress is being made in our work, no thinking dentist would dare attempt to refute. Two things occur to me in this connection that I will mention because I believe you will see, as I do, that they mark long strides of progress. First, the extraction of teeth in the treatment of malocclusion, over which so many caloric encounters have been waged in the past, has no longer any very considerable number of advocates. Without pretending to dictate to men whether, in some rare instance, the extraction of a tooth might be permissible to the end of furthering successful treatment of a given case, I do believe that as a common practice it deserves to become obsolete. In the vast majority of cases of malocclusion being treated to-day in all this broad land recourse to extraction is not thought of for a single moment. This bodes well for the perpetuation of this principle, which has been so strongly advanced by Dr. Angle as well as by the members of the American Society of Orthodontists.

Early Treatment.

The other point I have in mind, wherein a much-deserved recognition is coming to the conscientious orthodontist, is with reference to the early treatment of dental irregularities. I firmly believe that where ten general practitioners of dentistry five years ago strenuously advocated the delay of treatment until the permanent dentition was completed (excepting the wisdom teeth), that six or eight of those same men would to-day insist on the treatment of the case as soon as the malocclusion was noted and fairly well marked. Further than that, some of our most progressive dentists are quite disposed to heed the warning of certain of our specialists, such as Varney Barnes and others, and in cases of delayed development of the deciduous dental arches they are coming to know that orthodontic assistance is a wonderful preventive of a serious condition of malocclusion in the permanent dentures. Is this not an indication of progress which we should hail with delight? The co-operation of the family dentist in the education of parents to an understanding of the far-reaching advantages of early treatment is certainly a vital thing. It is no slight compliment to those men who make up the majority of specialists in orthodontia that in the two very important considerations which I have noted the profession is co-operating to so full an extent as at present.

Prophylaxis.

I wish to allude to two or three phases of our work which I believe are not receiving the careful consideration which their importance demands. The first is Prophylaxis. In the general practice of dentistry more attention is given nowadays to prevention of dental and oral disease than at any other age in the history of the profession, I am sure. I think it has been adequately demonstrated that caries of the teeth is wholly preventable, granted the necessary prophylactic measures are being followed out in a given case. But very often the price of immunity is the most constant watchfulness, both on the part of the patient and on the part of the dentist or oral specialist. Now, I do not believe any of us think that orthodontia appliances, any more than crowns, bridgework, artificial dentures, etc., are conducive to asepsis of the mouth. It does not follow, however, that the use of such appliances renders oral prophylaxis impossible. Many of our patients wearing orthodontia appliances are, beyond doubt, enjoying a *more healthy* oral cavity than was true of them before treatment of their malocclusion was started. That is true, because the conscientious specialist spares no pains in educating his patient in the use of suitable prophylactic measures, whereas such attention to the mouth and teeth is so commonly neglected or only half performed. The immunity to disease-producing conditions from such a source will be in direct ratio, therefore, to the zeal of the orthodontist in the indicated direction and to the actual prophylactic services he renders the patient himself. It is presumed the patient will follow, more or less carefully, such directions as he may receive looking to the cleanliness of the mouth during treatment.

Gentlemen, in some instances the cause of caries of the teeth, incipient or otherwise, has been laid at the door of the orthodontist. Whether the accusation be just or not, it would be rather strange, at this comparatively early stage of development of our science, if there were not a few such instances that could be so traced. My own impression is, that as a body of specialists, we are not as careful as we should be in this particular. The requirements of the careful prophylactic care of our patients are by no means small. This special attention is needed not only during the period of active treatment, but likewise throughout the time when the retaining fixtures are worn in the mouth. Let us think deeply of this matter. I trust we may not deceive ourselves into believing that neglect of this character can be productive of other than harmful results. Then let us select, and systematically apply, such efficient prophylactic measures as will preserve the teeth intact in all the period during which the patient is under our care. We will thus serve our patient well, and possibly save ourselves some unnecessary humiliation.

Retention.

We are learning something about retention, and with no disposition to pose as an authority on this very important subject, I would simply indicate a point or two that have appealed to me with a great deal of emphasis. I have an impression that some orthodontists have misjudged the force which is exerted by the jaws in the mastication of food. It might be well for all of us to secure Dr. Black's ingenious instrument, the gnathodynanometer, and do a little experimental work. That might serve to bring to our minds afresh the fact that a tremendous pressure is often exerted in the use of the jaws. Overlooking this, in part, too often our retainers are made in too flimsy a manner. Very thin platinum bands, carrying (as they sometimes do) a strong lingual wire, too frequently give way under the stress of mastication. The result is an inconvenience to the patient, with additional work for the orthodontist. Sometimes it may mean a relapse of the work, as might readily occur if the breakage happened while the patient were on a protracted vacation. I think it is well to study this matter of stress pretty thoroughly, with a view to having whatever appliances we place in the mouth for retention purposes sufficiently strong to render efficient service. Molar retaining bands of German silver, which I at one time used, too often disintegrate in the mouth to be satisfactory. Platinum, coin gold, or an alloy of gold and platinum should be used.

Treatment of Mature Cases.

One of my very early experiences had to do with the treatment of a mature case. Judging either from the standpoint of age or from the extreme condition of malocclusion it was a mature case! I entered upon the correction with a good deal of enthusiasm, and I learned a good deal during the ensuing four years. I learned that we can move teeth with absolute certainty, no matter what the age of the patient may be. I also learned that I could retain the teeth after the tooth movement was completed. I learned two other things: first, that sufficient development of the face necessary to a fair degree of harmony of features was not realized, and, second, that permanence of retention cannot always be expected under such conditions. Now, that experience was invaluable to me, but it was somewhat dearly purchased, I think. My patient has never complained of any dissatisfaction, but I am my own most critical judge.

I think the general impression is held by orthodontists that treatment of malocclusion after maturity is reached is a rather unsatisfactory practice, but, so far as I know, our literature is very deficient in scientific data touching upon this important matter. I think a splendid field is here open for investigation, and for one I should welcome some careful studies along this line. I have the belief that in many mature cases that seek help a great deal can be done, but I also believe we must bear in mind these two things: How much additional bone development (if any) may we expect, to meet the requirements of the enlarged dental arches and of a proper facial balance? And also, may we not need very often to resort to permanent retaining fixtures in case we do work under such circumstances?

The Future of Orthodontia.

What of the future of orthodontia? I believe the next decade or two will add very much to our knowledge and equipment for efficient work. There are promising fields of research to be more fully explored that relate intimately to the successful treatment of malocclusion of the teeth.

So far as I know, there has not been suggested any practical method of measuring the changes which expansion of the dental arch produces in the development of the nasal sinuses and the cavities accessory thereto. That the correction of malocclusion does most frequently assist nature in the normal development of these air passages, there is no longer room for doubt; but if by actual measurements we could determine the extent of the improvement in a given case, that data would go a long way toward convincing those who may be skeptical. The rhinologist, as well as the orthodontist, would welcome some method of this kind.

I have already referred to the importance of determining the extent of bone development in mature cases. It is believed we may not expect a great deal after maturity is reached, and doubtless this is correct. But may we not have a clearer knowledge of just what constitutes maturity as it applies to this matter? And again, is it not possible that the requirements of treatment of these mature cases may be very different from the ordinary case in some respects that we have partly overlooked? What might be the effect of a very slow movement of the teeth in such a case, spending as many months as we would weeks in treating a child of eight or nine years of age?

Have we learned how to deal successfully with all those abnormal forces which may operate after treatment to produce a recurrence of the malocclusion, even though our work be ever so well accomplished? I refer to mouth-breathing, faulty habits of the lips and tongue, etc. The force of habit is so very strong that these tend to persist after their real cause has been removed. A better understanding of these negative forces and improved methods of dealing with them are to be desired.

Truly we have come a good way on the road in a brief time, and the tendency of such rapid progress may be to cause us to feel that the end of the journey is almost at hand,—that not so very much more remains to be accomplished. It is a common thing for men, as they contemplate a certain superior method of doing a stated thing, to conclude that there remains no further opportunity of advancement in that direction. But the accepted theory and practice of to-day may become obsolete to-morrow, making way for still further progress. It is well, therefore, to take the broad view of our work which it well deserves. By doing so we may have an ever-widening conception of orthodontia, and this will mean a larger ability and an increasing appreciation of those whom we serve.

Discussion of President's Address.

Dr. C. A. Hawley. Doctor Gray has given us a very comprehensive view of the work before us, and of the problems with which we are confronted at the present time. Many of them hardly admit of controversy at all.

The President spoke of the history of orthodontia, as gleaned from the old works, and it seems to me that in a few years' time it will be profitable for some of our members to take up the preparation of the history of orthodontia, distinctly by itself; a history of the knowledge of orthodontia, in theory and appliances. Our work is necessarily closely connected with appliances, and the doctor has spoken in his address of some tendency to apologize for paying a good deal of attention to clinics and to the mechanical side of orthodontia. That has been evident a great deal in some of our general dental meetings. As for myself, I have no apology, and never had, for a tendency toward the mechanical. It is necessary to our work and does not in any way detract from the value or dignity of dentistry or of orthodontia. We may know ever so much in theory, but unless we can carry it out in practice, our standing before the people whom we serve is nothing. The greatest problems we have are connected with the practical.

Problems of Early Treatment.

In two or three instances, which the President has noted, the tendency toward the treatment of young children (which is now so efficiently done) is brought to us through a theoretical understanding, but where would we be if we could not carry that out in practice? Our success comes, secondarily, through being able to do the work. What does it matter to a person bringing you a young patient, what you know of the patient, the needs of the work or the desirability of it, if you cannot do it? The treatment of young children depends upon the use of appliances: what we can do for older patients with a certain appliance may not be done for the child. Appliances must be different, and must be differently handled. We have the constitution of a child; the appreciation which he may or may not have of our efforts; the ability to withstand the annoyance and slight irritation of appliances; we have all these to consider. No parent will bring a child to you to treat if you so conduct your treatment as to interfere with his education, nutrition, or development, which probably ten or fifteen years ago would have been done necessarily. Now our success in this direction depends largely on our study of the mechanics of orthodontia, and I will say again, I hope we have reached a time when we need no apology for the mechanical side of our profession.

Treatment of Adults.

In the treatment of older patients, there again I will say, what we accomplish for older patients has a great deal to do with our mechanics. The problem which Doctor Gray stated, I think has been very well stated. The most desirable patients are not the older patients. We will all agree with that, I think. There is a certain age at which it is most satisfactory to treat patients, and we all like to have them at that age, but yet it seems to me that it is our duty not to neglect that which may be done for older patients. There are certainly some things that can be done to advantage. There are certain limitations we must understand, which have not been fully worked out. There is a great field for work in that direction. I have had some experience in the treatment of older cases. Some have been successful and well worth while; and some have not. I would welcome a further study of the limitations of that work.

Prophylaxis.

In regard to the question of prophylaxis, and of the injury to the teeth of patients under treatment, we have had considerable discussion of that matter in our meetings in the past, and we need a great deal of discussion in the future. I have no doubt in my mind but that orthodontia appliances may tend to injure the teeth of patients. I am reminded of a statement that I heard from an experienced anesthetist a few weeks ago, in regard to one of the safest anesthetics known. He says: "You can kill patients with any anesthetic in the world," and you can injure the teeth of patients with any appliances you put in the mouth, no doubt; but with the careful treatment which we should use there is probably no danger. Yet we need more study in that direction. We need to know better what is necessary to do to care for this phase of the work.

In regard to the future of orthodontia, it seems to me that in almost every direction that we look, we have just begun. I do not know when I have been as enthusiastic in regard to the unsolved problems of orthodontia as I am to-day. I am less in the attitude of thinking the appliances are anything near perfect. I think that I never was more enthusiastic than to-day in regard to what we can do in the future. We have done a great deal. As the President has reminded us, there are certain things well established to-day that were not established ten years ago. We are sending out, probably at a low estimate, eighteen hundred to two thousand patients in this country annually who have been well treated. That is a tremendous missionary force, and I am seeing, month after month, its effect among people who come to me in various ways; and the knowledge of our work as specialists is growing rapidly among the people, and we will go on from year to year, adding to this immense missionary force, and I think we should all be enthusiastic over the prospect.

Dr. Robert Dunn.

In this excellent address just given by our good friend and president a number of things are mentioned that are forcibly impressed, I believe, upon the minds of every thinking orthodontist as he advances in experience.

One in particular: The early treatment of dental irregularities, or what might be termed preventive orthodontia. While this all-important subject has been given some attention from members of this society, it has not, however, received that consideration to which it is entitled, and which we as members of a progressive scientific body should give it. I fear the trend has been too much toward the invention of appliances to correct and retain progressed or completed cases. Many possess merit, I admit; many others, however, are altogether impractical and unhygienic.

In the construction of appliances simplicity as well as efficiency should always be considered, for in orthodontic treatment one is just as important as the other.

Early Treatment. When I think of those little children of tender age that I have been fortunate to have had as patients, in whom every indication pointed toward a malocclusion of an extreme type, with the possible development of features painful to look upon, greatly handicapped in the struggle for existence, as thousands are now afflicted, and I now see what nature, after a comparatively short period of treatment, is accomplishing, I cannot help but loudly proclaim, whenever the opportunity presents itself, the great benefits to be derived by early intervention. When one studies the teeth and adjacent tissues from an histological standpoint, the positions which the developing permanent teeth occupy before eruption, and their relation or close approximation to the deciduous teeth, coupled with the etiology of malocclusion, he can come to but one conclusion, and that is, that the time to begin treatment of dental irregularities is before the eruption of the permanent teeth.

Again, mechanical force intelligently applied to the deciduous teeth at this period seems to stimulate nature to renewed energy in her development along normal lines. Simple appliances for treatment can be used, and the result more simply retained, which means the minimizing of the danger of caries. I believe it can be safely predicted that in ten years hence there will be few if any cases of malocclusion of the teeth to be treated after the eighteenth year of age.

Prophylaxis. In reference to prophylaxis, that is a source of worriment, I believe, to all conscientious orthodontists. It is no small task to be ever watchful of the careless boy or girl, especially when the parent is inclined to be lax in discipline as to oral hygiene.

I do not believe the time will ever come when we will be able to entirely prevent the disintegration of tooth structure in all of our cases, regardless of all due vigilance on the part of the operator or patient, or whether noble or base metal constitutes the material from which the appliances may be made. I have seen cases where the greatest care, down to the minutest detail had been given, yet disintegration occurred, and apparently over night. We can, however, as the essayist states, minimize the danger of such occurrences, as, for instance: In the employment of simple and effective appliances; beginning treatment at a very early age, and the charging of such fees as will warrant the employment of a skilled assistant, as has been mentioned by others at previous meetings of this society. While we should be ever watchful to prevent disintegrations if possible, yet where it does occur in a small degree, in those cases where the treatment is of great benefit to the health and facial outlines, it should in no way reflect upon the operator, nor be considered a reason for deferring treatment of like cases, and should not be too severely criticised by the dentists, as they occasionally live in glass houses and should not throw stones.

Treatment of Adults.

In reference to adult cases, I assume the essayist refers to those after the eighteenth or twentieth year. There are a great many things, of course, to be considered in these mature cases before treatment should be undertaken, but just what conditions will permit of treatment with satisfactory results is a problem that, for the present, must be left to the orthodontist, his ability to judge in a given case depending upon the amount of practical experience which he has had. We will, however, I believe, in a few more years, be able to obtain from carefully kept records, from the members of this society, much of value bearing directly upon this subject. I will state that in a large percentage of those cases where there are teeth missing, and they can be replaced by artificial means, we can feel assured of a reasonable amount of success, providing, of course, the artificial substitutes are properly constructed, and there is not the extreme contracted arches calling for a great deal of expansion. Again, in those cases coming under Class I., where there is little root movement to be made, and retainers can be worn for several years, we will be safe in undertaking the treatment. However, we cannot expect bone development, at least to any appreciable extent, and the extent of improvement in the facial lines will be only as the crowns of the malposed teeth affect the facial muscles independent of bone development.

Dr. Henry C. Ferris.
(New York.)

The prophylactic point of view has been one of considerable interest to me. So far as its being a solved problem is concerned, that is a good way off. In my experience with the method presented by me to this society a few years ago the use of potassium iodide solution has proven very satisfactory. In my work in New York I eliminated its use as an experiment, to make a note of the general effects on all the cases treated. I found there were marked indications of acid erosion in a number of instances, under what I would consider a little more than ordinary care of the mouth, using the mouth washes on the market to-day. The alcohol bases and alkaline bases were used in my New York office, and I noticed this spring several etched surfaces on cuspids, and some on molars, where bands had been set with cement. In some instances those bands were of precious metal, and in others of the base metals. In my Brooklyn office I have not noted any such action after carrying out the technique which I presented to this society a few years ago. The practical illustration came to me without previous thought—that is, beyond the fact that I carried out this method for comparison. There was a marked difference in these mouths. The reason for it is hard to explain, except from the standpoint of the use of the iodide of potassium, as its effects on the mucosa are marked. For instance, the iodide of potassium will produce a reflex action on the saliva for three days. If you spray your own mouth with the solution as recommended you will note in the mouth a metallic taste for three days. This taste, of course, abnormal, and yet the reflex action on the mucosa is marked, and you can set up mechanically a condition which may act beneficially on the whole mucous membrane. That is only a thought, and it has not been proven.

I believe Dr. Gray's address has covered the subject very beautifully, and I think he has touched upon some most vital points for our consideration.

Retention.

There is one point with reference to retention, of which Dr. Hawley has spoken, and which I belive needs another direction of thought, and that is, when retaining deciduous teeth, we must take into consideration the histological growth taking place in that region. I have noted with great pleasure the fact that I can retain teeth at certain ages without retaining appliances, to the great benefit of the patient, and I am retaining more teeth by *not retaining* them than I ever did before in all my experience. For example: I correct a case at ten or eleven years of age, Class II., Division I.; treat it until the biscuspids lock normally and let the case go. Then I take it up after three months and watch it again. Sometimes there is a tendency to drift distally and I treat it again, but the results are fifty per cent. better than I ever have secured by mechanical retention.

We must remember the fact that the skull is growing downward and forward, and that we are working with—or should work with—the growth, and not retard growth by any mechanical retention. When retainers are used there should be movable connections wherever our confacts are made. That is the underlying principle which is actuating my procedure. I thank you, gentlemen.

Dr. A. H. Ketcham.

Mr. Chairman:—I have enjoyed this most excellent address, but have little to say except to compliment our president. There is one point of which he speaks, namely, the remote period when malocclusion was first noted, the records going back twenty-five centuries, and of course these records were of civilized people and not of savages. To-day malocclusion in savage races is uncommon. With the civilized races, pathological factors, such as adenoids, mouth breathing, etc., help to cause malocclusion; but it seems to me that it is largely due to lack of normal function or use of the teeth. Civilized man does not use his teeth as much as he should, and therefore he suffers from malocclusion, caries and other dental ills.

Prophylaxis.

Prophylaxis is very, very important. For a number of years I paid a great deal of attention to prophylaxis, combining its practice with that of orthodontia, but I gave it up two and a half years ago, turning that part of my practice over to Dr. Hamm, who is now associated with me. We must take care of these little patients and keep their mouths clean while they are undergoing orthodontic treatment. The parents sometimes ask if the teeth will not decay with the appliances in the mouth. My answer is that the child's mouth is usually not as clean as it should be, and while the presence of the appliances might afford lodging-places for additional food *débris*, and so tend to dental decay, yet during treatment the orthodontist pays close attention to prophylaxis, and the child also pays more attention to the cleaning of his teeth than before, so that there is really less likelihood of decay than ever before in the child's life. This usually satisfies the parents.

Treatment of Children.

I also note Dr. Hawley's statement that children years ago suffered from orthodontic treatment so that they were not as well as they were before the appliances were placed in the mouth. To-day I think it is the experience of men who have been practicing orthodontia a number of years, or who have acquired the skill and judgment to treat these little patients painlessly, that these children will usually grow and increase in weight faster than could be expected during our treatment. This is partly because we impress on the parents the fact that the child must live a hygienic life as nearly as possible; that it must have good food and keep regular hours. Some of my little patients delight in telling me they were out to a party, or to a dance until a late hour, because they know I do not approve of it. The majority of mothers are sensible, and where they see that you are striving for the child's well-being, they will co-operate with you, with the result that the child improves in health and is kept up to par or above par instead of being pulled down by the orthodontic treatment.

Treatment of Adults.

As to mature cases, I at first treated a good many of these and the experience was invaluable to me, because it taxed my patience and ingenuity to the utmost. In regard to the retention of these cases, I think one or two partly relapsed, but in most, permanent retention was used on some of the teeth, just as in a bad pyorrhea case. Nowadays I treat but few adults, for I find that with a practice full of children a greater percentage of benefit may be enjoyed by a larger number of people.

Dr. H. A. Pullen. Prophylaxis.

On the subject of prophylaxis I wish to state that I have had the same experience as the rest of you in trying to ward off some of the troubles that our little patients have as a result of not taking care of the mouth, and once in a while we will note a little disintegration, or white decay of the enamel. I do not think it is due to our appliances, but rather to the patient's neglect to take care of the mouth in the home. Especially in those cases which we only see once each week do we need to be watchful, for, as one gentleman has stated, a great deal of harm can occur over night through acid disintegration, etc. I think there are certain portions of the mouth or parts of the dental arches which are more prone to this disintegration than others, and of these portions those most prone to this disintegration from this acid or chemical disturbance are the labial surfaces of the lower incisors; next to those, perhaps the labial surfaces of the upper incisors, and next in order the buccal surfaces of the bicuspids or the molars, and finally the lingual surfaces of all of the teeth, and possibly to some extent the approximal surfaces of the teeth. With these facts in mind, would it not seem reasonable to give the greatest attention to the surfaces most prone to such disintegration? For that reason I have made it a practice in the last year or two to make bands in very young cases—say between the ages of six and nine or ten—to fit the four lower incisors, following the contour of the gum-line so that there was no possibility of the food collecting next to the enamel surfaces of those teeth, and my experience has been such that I am much gratified with this method, and I do not feel at this time that I would like to change it.

In any cases where I have fear of enamel disintegration I put on that form of band on the four lower incisors, and sometimes on the two upper central incisors, pinching the bands on the labial surfaces, and leaving a little groove or wedge-shaped opening for carrying the arch and supporting the same.

I would bring forward another point, and that is with reference to the use of silver nitrate in the mouth. It has been stated that this drug will prevent this acid disintegration, and I am convinced from my own experience that this is absolutely true. Objections have been made as to the use of silver nitrate, because of the dangerous character of the drug. Now, there is apparently only one bad result from its use, and that is the discoloration of the enamel and dentine. The question resolves itself into one of how we can remove this stain. There is only one satisfactory method, and that is by the use of potassium cyanide. I have always been afraid to use it, but it will completely remove these stains, and very deep ones, too. I advise its use with a great deal of caution.

Treatment of Adults.

With regard to treatment of mature cases, I have succeeded in establishing some very beautiful results for patients as old as forty-four, but most of these cases required more or less permanent retention, especially Class III. cases.

I wish to compliment the president on his splendid address, and thank you for your consideration.

Dr. Gray.

I was pleased to hear Dr. Hawley emphasize the mechanical side of our work. Appliances *are* important, and while a skilled man may successfully use an inferior appliance, in the end it is the efficient appliance, skillfully managed, that produces the best results.

I was rather expecting that some of the gentlemen who discussed my address would tell me that the treatment of mature cases of malocclusion is usually if not always contra-indicated. But they have not done so, and I therefore believe that they agree with my opinion, that in selected cases at least, a great deal of success may follow skillful treatment and retention, and I would emphasize "retention" in this connection.

We owe a good deal to Dr. Ferris for certain efficient prophylactic measures which he has presented to this society in the past, and in the use of which he meets with so much success. It is worth our while to profit from his varied experience. His point as to the over-retention of the cases of young children is interesting, and I believe he is correct.

Dr. Ketcham believes that in treating the average case there is really less likelihood of decay than ever before in the child's life, because of the added attention paid to prophylaxis during the treatment. That is very good and is in accord with my belief, as I think I indicated in the address. It is a good argument to present to those parents who may have some question as to the health of the teeth during our treatment of cases.

Dr. Dunn and Dr. Pullen have each touched upon vital points, but I will not take the time to make further comments. I am gratified because of the liberal discussion of my address.

Death of Pulps Due to Tooth-Movement.

By J. P. Buckley, Ph.G., D.D.S., Chicago.

In presenting for your consideration the subject of death of pulps due to tooth-movement I desire first to acknowledge my indebtedness to Dr. Ottolengui and to your secretary, Dr. Kemple; to the former for the encouragement and assistance given me in the preparation of the paper, and to the latter for sending a letter, with a list of questions enclosed, to most of the men engaged in the practice of orthodontia in Europe, Canada and the United States, from which source much of the data contained in this paper has been obtained. I also desire to take advantage of this opportunity to thank the various men who replied to the above-mentioned letter, as I did not take the time to reply to each individually.

I must admit that when I finally accepted the invitation to present this paper I did not experience at once that enthusiasm which generally characterizes my work; but as the letters came in and I studied the opinions on this subject from the men who have been actively engaged in orthodontia, I gradually became interested, and before the paper was completed my enthusiasm could not have been greater had I been a full-fledged orthodontist.

My personal experience in the correction of irregularities of the teeth is very limited, being confined to the first two or three years of my practice; yet, so far as the subject of death of pulps is concerned, it was sufficient to include one tooth, an upper lateral incisor, the pulp of which died from too rapid movement, and this I find is more experience than many of you have had in your several years of practice.

The number of replies which I received from the letters sent by your secretary was seventy, and the first part of this paper will deal largely with these answers. Coming, as they do, from men of both or all schools of orthodontia, and who have had from five to, in many cases, thirty or more years of experience, we should arrive at some definite conclusions.

Questions Submitted.

The questions submitted to be answered here follow:

First. Have you ever had the pulps of any teeth die during orthodontic work?

Second. Can you state which teeth suffered in this respect?

Third. Did you attribute such death to the movement of the teeth?

Fourth. Was there any history of traumatism or accident to the tooth while loosened up by the forces applied in orthodontia?

Fifth. Do you believe that any particular tooth is more likely to suffer in this way than any other teeth in the arch? and, if so, why?

Sixth. Have you had any teeth die as the result of rotating teeth in their sockets?

Two more questions were suggested by Dr. S. H. Guilford and have been answered incidentally by various men, including himself. These questions follow:

Seventh. What form of movement is most likely to result in pulp devitalization?

Eighth. At what age is devitalization most likely to occur?

Replies.

Of the seventy men who returned answers to the above questions, thirty have never had the pulps of any teeth die as the result of orthodontic work, while forty have had the pulps of one or more teeth die. The teeth thus affected include upper central and upper and lower lateral incisors, upper and lower cuspids, upper bicuspids, and lower first molars. Of the forty, twenty-four have had the pulp of one or more upper central incisors die; thirteen have had one or more lateral incisors thus affected—all upper except two; three have had the pulp of one or more upper cuspids die; one has had the pulp of lower cuspids die; two have had the pulp of one lower first molar die; while only one had the pulp of a single upper bicuspid affected.

Thus we learn from the experience of these men, which, I think, can well be taken as a standard, that the upper central incisors are most likely to suffer in this respect, and next to these come the upper lateral incisors. In fact, death of the pulp in all other teeth occurs so infrequently in orthodontic procedure that they can almost be dismissed without further attention. The two lower first molars reported to have had the pulps die, both carried large amalgam fillings, and the death was attributed to possible infection from the cavities, before the fillings were inserted, rather than from the tooth-movement. In the case of the one bicuspid, little history was given, except that the patient was over twenty years of age. No history was given for the death of pulp in lower cuspids. In the cases where the pulps of the three upper cuspids were affected the patients were all over twenty years of age, and in one case (twenty-six years old) the expansion from tip to tip of cuspids was about 1.4 inches, the time consumed was five and one-half months, and, so far as the operator was able to determine, the devitalized cuspid was not moved further than the one which retained its vitality. The chances are, however, that while the tip of the affected cuspid may not have been moved further than the tip of the unaffected one, there must have been a greater movement in the region of the apex of the affected tooth. In reporting the death of the pulp in a lower lateral incisor one operator referred to the fact that there seemed to be a lack of development of the anterior portion of the lower arch, with very thin covering of alveolar process over the incisor roots. Only one other case of death of the pulp in lower incisors was reported.

Inasmuch, then, as the upper central and lateral incisors are the teeth more often affected, so far as the death of the pulp is concerned, in orthodontia treatment, it will be interesting to hear the various causes assigned for such death.

Causes of Pulp Death During Treatment.

Many believe that the upper incisors are more often out of alignment than any other teeth, and consequently a greater number of these teeth need orthodontic treatment; also that they respond readily to the forces applied in orthodontia. The thought is advanced that death of the pulp is most likely to occur when teeth are moved bodily, where the apex is driven through the process to a considerable extent, and that the upper incisors call for such treatment more frequently than other teeth. Others believe that rotating a tooth in its socket is more likely to cause strangulation of the pulp than any other movement, and that the upper incisors require rotating more than any other teeth in the arch. All who expressed an opinion believe that risk is greater in rotating *when the root is fully formed.* In other words, the older the patient, the greater the risk. With one exception, it is believed that in all tooth-movement devitalization of pulp is most likely to occur only at or later than maturity, when the apical foramen has become constricted through completed calcification.

One prominent man, however, is of the opinion that death of the pulp is more likely to occur when the root is not fully formed. No reason was given. A report was received of three cases of death of the pulp in upper central incisors with the patients ranging in age from fourteen to sixteen years, though the movement was slight in every instance. In one of these cases a single thickness of tape carried between the teeth caused death of the pulp in one central. It would seem that there must have been some previous history of traumatism or accident to this tooth or else the general vitality of the patient must have been very low.

A few are of the opinion that the upper centrals are more apt to have the pulps affected because of their prominent location in the mouth, and while loosened up by the forces of orthodontia they frequently receive some traumatic injury which results in devitalization. The histories given for the death of the pulps of many upper central incisors tend to support this view.

An interesting case is reported by one man where one upper central was absolutely in its proper position, but the other upper anterior teeth required considerable moving. When the operation was nearly completed a pink discoloration was observed in the properly placed central, and on drilling into the tooth it was found that the root was not fully formed, though the age of the patient was such that under ordinary conditions the root would have been fully developed. Another somewhat similar case was reported by the same operator, and he has concluded that the teeth which are moved the least are the most likely to be affected, especially if they are used for anchorage purposes.

One man reports a case where the pulps in two upper central incisors died under quite rapid movement, and relates that the vitality of the patient was very low at the time. If I were to inject any of my own ideas into this paper at this time I would say that the vitality of the patient is an important factor to be considered in the death of the pulp from whatever source. My experience in trying to save the pulps of teeth when irritated from external influences led me to say in my book on "Practical Therapeutics," with reference to the treatment of exposed or nearly exposed pulps:

"Any attempt to permanently save an exposed pulp in the mouth of a patient who is suffering from some systemic derangement interfering with the general circulation, thus lessening vital resistance, would doubtless result in failure; for in such cases the pulp would fail to receive from the blood supply the necessary elements for the restoration of its functional activity."

Death of Pulps in Lateral Incisors.

The foregoing opinions have been largely those relating to the death of the pulp in the upper central incisors. We will now consider the opinions which deal with the upper lateral incisors. Several, in stating that these teeth were more likely to be affected, gave as their reason the fact that the lateral root is often curved, and in some cases, where malocclusion is developing, the end of this root frequently comes in contact with the advancing cuspid. One gentleman thought that the upper laterals were more liable to be affected when rotated, because the root-end is so often curved that when rotated the apex is moved more than with other teeth. One upper lateral was reported to have had the pulp die while being depressed in its socket. In support of the view that the upper lateral incisors were more likely to suffer, the reason given by one was their small size relative to the forces employed, and their frequent greater displacement, *i. e.*, greater in proportion to their size.

It would be interesting to know the number of the upper central and lateral incisors, the pulps of which have been reported to have died under orthodontic treatment, that had gold, artificial enamel or cement fillings inserted before the latter treatment was undertaken. Several mention the fact that some kind of filling was in the tooth before they began the orthodontic work. Others relate a previous history of accident. As many of you know, I have had a great deal of experience in bleaching teeth, and I have found more discolored upper lateral incisors due to death of the pulp than all other teeth combined. I have attributed this to the fact that the crown of this particular tooth is so small, that when a metal or artificial enamel filling is inserted, both materials readily transmitting thermal changes, it encroached so nearly upon the pulp that death of the organ frequently resulted. In my private practice and in my teaching at the college I advise the removal of the pulp in these teeth when the cavity is of any depth and the root is fully formed. This is to prevent subsequent death of the pulp and possible discoloration of the tooth-structure.

In one instance specific mention was made of the new ligature now being used by many orthodontists, which, by its rapid action and consequent change of the apex of the tooth, is a prolific source of dead pulps. What this new ligature is you doubtless know; I do not.

Influence of Blood Supply.

There seems to be a prevailing opinion among some orthodontists to the effect that the anterior teeth, both upper and lower, receive their blood supply from smaller blood-vessels, for the reason that they are situated in the arch farther from the source of supply; and therefore, when these teeth are moved, the pulps are more likely to be affected. On this point in particular I wrote to one of our foremost histologists, Dr. Broomell, of Philadelphia. He says: "My actual experience in orthodontia has been quite limited, including, generally, cases of a simple nature. My reply to your questions will, therefore, be a general one, based chiefly upon what I think takes place, this belief being acquired from my work along the line of histology and development of the parts involved. I believe I am already on record in the proceedings of the American Society of Orthodontists as favoring the idea that the movement of young teeth, as generally practiced in orthodontia, would not endanger their vitality. I believe this to be especially true before the roots of the teeth are fully calcified, during which time I am convinced that no vessels, other than those contained within the dental follicle, or its remains, the forming peridental membrane, enter the wide-open root apices.

"In the rotating or lateral movement of such teeth the root and follicle are necessarily acted upon at the same time, and there can, therefore, be no marked strangulation of the blood-vessels in and about the tooth. In older teeth—those with their roots fully formed—the conditions are different, but even here I doubt very much if the death of the pulp ever follows careful orthodontic procedure. I believe that the lateral movement of a tooth would be more likely to interfere with its vitality than rotation, but I cannot see that the anterior or simple teeth might be more easily devitalized on account of the size of their blood-vessels, because these are practically of the same calibre as those going to the individual roots of the complex teeth."

The reply from Dr. Frederick B. Noyes, of Chicago, came late and was, therefore, not incorporated in my original copy which was sent to the discussers. It follows:

"In reply to your questions in regard to the 'Death of Pulps in Orthodontia,' it is certain that there has been more or less trouble from the death of pulps in the moving of teeth.

"In my own experience I have never had a pulp die during or as the result of tooth-movement, but I have seen several cases in mouths treated by others, and am therefore not in a position to answer the third, fourth, fifth and sixth questions. I have thought a good deal about the causes of the death of pulps, and from the study of the structure of the tissues and the nature of the blood supply it has seemed to me that death of the pulp, at least in young persons, must be due to the cutting off of the blood supply. This I believe to be possible in two ways: first, by purely mechanical conditions, the blood vessels which enter the pulp being squeezed between the root and the bone or between stretched bundles of fibers. Second. By the production of inflammation which would result in stasis in the apical space. Both of these conditions must be considered as the result of the use of improper and excessive force. The former is much more likely to occur by the use of excessive force in the early stages of movement. The latter, by the improper use of force in the later stages. If the tooth is not held firmly, but is allowed to recoil, as from an elastic ligature, under the pressure of the lips or tongue, or in the use of the teeth, the blood vessels will be sawed between stretched bundles of fibers with every movement. The result of this sawing on the wall of the blood vessels is to excite an acute inflammation, which may result in stasis and consequent death of the pulp. It is possible that the central and lateral incisors, because of their positions, may be more liable to these conditions, but I know of nothing in regard to their blood supply that would put them in a class by themselves. I believe that death of pulps in orthodontia movements should be very rare."

The opinions of Dr. C. S. Case and Dr. E. H. Angle, which accompanied their brief answers to the list of questions, in view of their extended experience, cannot but be of value to all who are interested in orthodontia.

Opinion of Dr. Case.

Dr. Case says: "The above questions are too inadequate to tell the whole story relative to the influence which orthodontia operations exert in causing the devitalization of pulps. In the first place, orthodontia as it is practiced to-day has a very wide range of character in relation to this subject. Toward the extreme on the one hand, it is a wonder that the life of far more pulps are not destroyed, and, on the other extreme, the vitality of healthy pulps should never be considered endangered through a skillful movement of the teeth.

"This difference depends partly upon the methods employed, but mostly upon the operator, because however scientifically constructed are the appliances, an inexperienced or careless operator may easily endanger the vitality of the teeth to which they are attached by forcing movements of the teeth more rapidly than it is possible for physiological action to take place. The greatest safely lies with teeth that are held firmly in the grasp of a regulating machine that permits no back and forth movement, and with which they are steadily but slowly moved to place. Hundreds of cases are on record of the bodily movement of teeth, a distance from one-half to the full width of a tooth, for patients from twelve to twenty-five years of age, and which left the teeth and surrounding tissues in a perfectly healthy condition.

"A 'bodily' movement (which means that the apical ends of the roots are moved with the crowns) would probably have a greater tendency to destroy the pulps of the teeth than other movements having the same display of special requirements and skill. By this I do not wish to infer that pulps have not died in my practice during movements of the teeth with no apparent reason for it, though I have always believed that it might have been avoided if anticipated, with a more perfect fulfilment of the higher physiological demands of orthopedic movement. In several instances, where dentists in distant towns have been employed to carry forward my cases, pulps have been destroyed purely through an unreasonable rapidity of movement.

"In the majority of cases in which pulps have died in my practice the cause has been traced to blows or some form of traumatic injury. Protruding front teeth, because of their prominence, are more subject to injury than other teeth.

"In a number of instances devitalized pulps, caused from injuries, have occurred before they were presented for orthodontic treatment, and in some of these the patients were surprised to learn that the pulps were dead, the slight discoloration and pain not indicating a serious condition. All of these patients, however, when attention was called to it, could remember the particular time when they received the injury, followed by pain and soreness of the teeth that caused the trouble. I speak of this because had I started the operation without discovering the condition it might have been attributed to the operation, even by myself. So frequently has this arisen that I now consider it imperative to carefully examine the teeth for devitalized pulps in all preliminary diagnoses."

Opinion of Dr. Angle.

Dr. Angle writes as follows: "Formerly it was not a very uncommon occurrence to have the pulps of teeth die during orthodontic work, but I am now positive that it was not due primarily to the movement of the teeth, but to inflammation due to the improper application of force in tooth-movement, or, more accurately speaking, to the too frequent relinquishment and reapplication of forces, thus allowing the springing backward and forward of the tooth in its socket, with the resultant severe strain on the circulation. And this is almost the only cause of soreness and inflammation in moving teeth. In driving bands to place, of course the smaller the root of the tooth, the more subject to injury from the sudden application and relinquishment of pressure. More teeth die as a result of rotation, and the more difficult the tooth is to rotate, naturally the greater the liability of the death of its pulp, from the frequent relinquishment and reapplication of pressure throughout the prolonged operation. Strictly speaking, I do not think it can be said that any one of the seven tooth-movements, as a movement, is more disastrous than any other. Naturally, I would say that liability to accidental death of tooth pulps would increase with the age of the patient.

"And finally, the death of pulps in orthodontic treatment is no longer excusable, and when it occurs it is the best evidence of ignorance or carelessness or both. Dead pulps are the relics of crude methods in orthodontia and are, in reality, a dead issue with truly up-to-date orthodontists, for teeth should be moved so gently and continuously as to avoid soreness and inflammation, and if soreness and inflammation do not occur there can be no death of pulps in tooth-movement. I do not think that even in the extreme cases of teeth with very crooked roots there would be even probability of the death of the pulp if the movement be conducted in a physiological manner.

"These are my candid views after much experience, close observation and long reflection, and I am very happy to tell you that I have just completed some experiments and methods which will enable us in the future to reduce the possibilities of irritation to the peridental membrane to the minimum. And although that might be said of the present methods, if intelligently comprehended, yet the new plan makes it almost impossible to so crudely apply force as to cause inflammation in tooth-movement."

Deductions.

In brief summary of the data obtained from these many sources I will say that the first, second, third, fourth and sixth questions are personal ones, while the fifth, seventh and eighth call for the expression of an opinion based upon personal experience.

The general answer to the fifth question, viz.: "Do you believe that any particular tooth is more likely to suffer in this way than any other teeth in the arch?" is in the affirmative, and the teeth named are upper central and lateral incisors. The reasons given are:

1. More frequent displacement than other teeth.
2. More readily moved when a given force is applied.
3. More apt to be injured by accident on account of their prominent location.
4. Curved roots of the laterals.

The general answer to the seventh question, viz.: "What form of movement is most likely to result in pulp devitalization?" can be given as follows: Any movement which involves the apex of the tooth, especially when the root is fully developed; as, for instance, when the tooth is moved bodily in any direction, or depressing, elongating or rotating a tooth in its socket.

The general answer to the eighth question, viz.: "At what age is devitalization most likely to occur?" is well stated by Dr. Guilford when he says: "Only at or later than maturity, when the apical foramen has become constricted through completed calcification."

In this paper thus far I have simply acted as the mouthpiece of others, and while it is a pleasure to do so on this occasion, and the position is one which affords many advantages, I, nevertheless, find it unnatural, for it is not in keeping with my previous training. Therefore, at the expense of being criticized, I will propound the ninth question myself, and straightway proceed to answer it in my own way, viz.:

Ninth. When devitalization of the pulp does occur in orthodontic work how should the tooth be treated so that permanent discoloration will not result?

Treatment in Cases of Pulp Death.

There is nothing more unsightly to a conscientious dentist or to an appreciative patient than a discolored tooth in that patient's mouth. And inasmuch as I am not an orthodontist myself, I can say that I know of no class of men who are more thoroughly in earnest and more conscientious in their work than those who are engaged in your specialty; and surely any patient who will take the time and go to the expense of having orthodontic work done must be appreciative. The usual sequelæ of accidental death of the pulp, though it need not be so to-day, is a permanent discoloration of the tooth-structure, and since we have found that the upper anterior teeth are most likely to suffer in this respect, the answer to the question which I have asked must necessarily interest you whether or not you personally do this work. There are two ways by which discoloration of the tooth-structure is produced when the pulps of the teeth are affected, as in orthodontic work. First, we have that pink discoloration referred to by many in their replies to the questions as the first indication that the pulp was affected. This is frequently, though not always, produced when the pulp is strangulated. Applications of certain drugs, notably arsenic trioxid, to the dentin or to an exposed pulp have been known to produce this characteristic color. How this discoloration is brought about is explained nicely by Dr. Kirk in the "American System of Operative Dentistry." He says: "It is now known that the pink staining of the tooth is brought about by a rupture of the stroma of the red blood disks liberating their contained hemoglobin, which readily penetrates the tubuli, the lumen of which is insufficient to admit the unbroken red corpuscle. This pink discoloration, resulting from the infiltration of hemoglobin solution, represents the first stage of tooth discoloration. The pink stain readily undergoes alterations, later on assuming a brownish tint, due to the breaking down of the highly complex molecule of hemoglobin into a reduction product known as hematin."

When this pink discoloration is observed the sooner the pulp is removed the better, for after the hematin is formed, causing a brownish discoloration, it is more difficult to permanently bleach the tooth. In removing the pulp and in the subsequent treatment, including the filling of the root, great care should be exercised in the selection of drugs used so as not to further discolor the tooth. If the pulp is removed as soon as this characteristic color is noticeable, before the stain has had a tendency to dry in the tooth, the normal color can be nearly restored by washing the dentin with warm sterile water to which about one or two per cent. of sodium chlorid has been added. After the tooth is treated and the root is filled, one or two applications of an ethereal solution of hydrogen dioxid will generally restore the tooth to its normal color, when the lingual cavity should be filled with a quick setting, light colored cement and a permanent filling inserted. Sometimes it is necessary to seal the solution of hydrogen dioxid in the tooth before satisfactory results are obtained.

The second way by which the discoloration of the tooth-structure is produced is when the pulp dies and decomposes, with frequently the ultimate formation of an abscess. Here the discoloration too often results from ignorance or carelesssness on the part of the dentist in treating the condition, for in many cases the pulp has died and an abscess formed with the tooth still retaining practically its normal color.

The mistake which is often made here is to drill into the tooth and leave the cavity open, with the end in view of affording drainage. This is a positive means of producing discoloration, for air and saliva, especially the former, will so change the iron compounds which result from pulp discoloration as to produce certain characteristic colors in the tooth-structure. The chemistry involved in this process I have explained in other articles and need not be here repeated. It is essential to remember, however, that to avoid discoloration in treating the putrescent canal or the abscess, the cavity in the tooth should always be hermetically sealed when the patient is dismissed. With the remedies we now have at hand this is always possible. I know that it is the general practice in treating such teeth to leave the cavity practically open for the first or second treatment. I know, too, that many teeth have been needlessly, and, some of them, hopelessly discolored by such treatment. When cases of this kind are presented for bleaching, the operator must be governed largely by the case at hand. No universal method can be given for bleaching teeth that have been discolored by careless methods of treatment.

Now, since I have imposed upon you to the extent of injecting some of my individual thought into this paper, I will conclude with the hope that the discussion, if not the paper, will be of interest and value to the society.

Discussion of Dr. Buckley's Paper.

Dr. Ottolengui.

Mr. President: It is needless to say that I have enjoyed this paper, because it is a subject which I have particularly wanted to see discussed in our literature for many years, and I think this is the first serious and logical discussion that has been given to it. I also thank Dr. Buckley for bringing in question nine, which I think is quite important.

There have been a number of causes assigned to the possible death of the pulp during tooth-movement, and it seems to me we may divide the causes now into two classes: first, those directly connected with the work, and, second, those of an extraneous character. For example, we may have unnecessary stress put on a tooth by the orthodontist not properly making application of ligatures. Again, we might have the same result from the same degree of stress reaching a tooth accidentally, and not through the fault of the orthodontist. That makes the two classes, and they are both, in a sense, traumatism.

I quite agree with Dr. Angle when he states that a tooth is practically safe in any of the tooth-movements, provided the movement is made slowly, and it would seem that the gentleman who reported the death of a cuspid pulp had broken this rule when moving the cuspid 1¼ inches in five months. That is too much movement for the length of time. That is a legitimate instance of improper stress placed on the tooth by the orthodontist. I would like to discuss traumatism now from another standpoint.

Traumatism During Tooth Movement.

Traumatism which may reach a tooth is of two-fold character: one from serious stress which may come to the tooth during movement is of the following nature: The orthodontist may have to deal with a patient who seriously objects to having any work done, and who devotes much time to removing his ligatures, and if he should succeed in putting on one ligature which resists this attempt, and the patient should remove every other ligature, there would be an immoderate stress on the tooth, which might, in twenty-four hours, elevate a tooth in its socket to a dangerous extent. This is one of the most serious problems I have had in the past year. I have had four patients who have persistently removed ligatures. I dismissed one, a boy, from my practice on this account. The others are girls and I have continued with the cases, but I have certainly suffered many nights of anguish because these children come in with appliances attached to one or two teeth instead of to several.

Case from Practice.

An interesting case is the following: I have been treating a Class III. case for a number of years—from childhood up—and I had a very rigid appliance, practically a Case contouring appliance, on the upper arch: the double bow for moving the teeth bodily. All the teeth in that arch, as well as in the lower arch, were practically bound together with bands on each tooth, and we used intermaxillary force to shift the bite. The child is docile, and reports all difficulties, and that makes the responsibility all the greater. If the patient obeys orders the result is on your shoulders, be it good or bad. This child called me on the telephone one day and reported that a central incisor was sore. I instructed her to abandon the intermaxillary ligatures until her next regular visit. On the second day she reported that it was still sore, and I had her come to the office. To find that front tooth positively sore and tender to the touch and yet tightly bound to all its neighbors surprised me very much. I left the ligatures off until the soreness died away. As soon as we renewed the intermaxillary force the soreness returned. Perhaps I was slow in making a diagnosis, but this eventually proved to be the truth: in shifting the bite there was produced an end-to-end occlusion which caused the greatest amount of masticatory stress to be on that one tooth. It was an atom longer than its neighbor and it received the full force of the stress. Instead of relaxing the force, as previously, I redoubled it, and as quickly as possible got the tooth over the bite, after which the disturbance ceased. We must watch, therefore, for the undue stress of mastication while the teeth are loose in their sockets.

Another kind of traumatism is where the patient receives an actual blow on the tooth from outside sources. There is no doubt that the fact that central incisors are reported to be the greatest sufferers is largely due to this. Outside of orthodontic practice, they are the ones which suffer the most; they are most frequently broken: the child is most likely to strike the centrals when he does fall. I remember a case in my practice long before we were undertaking early treatment where a child was brought to me with her two upper incisors very prominent, and the parent wanted to know if the case could not be left until later for treatment. I said, "Yes, but I am afraid she will fall down and break the central incisors," and so I began treating the case solely for that purpose, and moved the incisors lingually. A year afterward she fell down and broke one off anyway. But I felt I had gained something, because only a very small piece was broken off, whereas she might ordinarily have broken off one-half of the tooth. The prominence of the centrals in the arch renders them more liable to receive a blow, and the fact that they are loosened in their sockets makes them more liable to suffer from the blow. The one instance of this kind in my practice is where a girl's brother struck her on the mouth with a toy trumpet. The pulp died, although it was not a heavy blow; this pulp was promptly removed, bleaching agents used, and discoloration prevented.

Rotation.

In regard to rotation, I think the gentlemen who have expressed an opinion that the pulp might die by rotation of the tooth are centering their eyes on the wrong end of the tooth. If you will stop to think how short a distance you move a tooth when you rotate it, looking at it from the incisal end, and then remember that it is practically a cone, and consider the extent of actual movement at the apex of the tooth, you must admit that it is measured in parts of millimeters.

So far as lateral incisors with curved roots are concerned, that manifestly cannot occur in the practice of to-day as much as formerly, because we move them before the root-ends are formed.

A gentleman once told me that he had rotated a badly turned central incisor a complete circle, and I asked him why he did not leave it where it was?

Of course, if the rotation of teeth be so rapid as to create a pericimental disturbance you might get an inflammatory condition and strangulation, which did not depend so much on the distance moved as upon the irritation set up.

I cannot accept the proposition of the gentleman who supposed that a pulp died simply from putting a piece of tape between the teeth. That death must have been due to something else. Neither can I believe that teeth used as anchor teeth, but not moved, can suffer. If they suffer they must have been moved, I think. Every expression of force is in two directions, and we often think we are using a tooth as stationary anchorage when we are not.

Treatment After Death of Pulp.

The advice to remove these pulps as quickly as possible brings to my mind a sad case. A patient of a confrere in another city, passing through New York, called on me with a note from her orthodontist, saying that if, in my judgment, the retainers should be removed, he was willing that I should remove them, and he described the condition as it had originally existed. Retainers had been on for two years and I removed them. I at once noted what seemed to me a slight discoloration of one of the incisors. It seemed slightly darker than the other. It was not my patient, however. If it had been my patient I should have promptly drilled into that tooth, so certain was I that the pulp was dead or dying. The patient, however, would in two weeks return to the city of the orthodontist who had treated the case. I advised her to immediately call on him. The disturbance progressed very rapidly, and actually while on the train to that city an abscess developed, the lip became swollen, and she was in great distress when she reached her home town. She was immediately sent to a very skillful dentist, and every precaution was taken to restore the color of that tooth, but without success. A beautiful girl was disfigured for life because I did not follow my own best judgment and drill into the tooth promptly. It has been my experience that when pulps are taken out immediately a very good result can be had as to color.

My treatment is to remove the pulp as quickly as possible. They are usually unresponsive to pain. Allow all the hemorrhage to cease. Wash out canals with a warm saline solution and then use a 25 per cent. pyrozone and seal it in for twenty-four hours, and prepare for a whole morning session on the second day. At that session I fill the canal and proceed with further bleaching, preparing the outer cavity for a porcelain inlay. With rubber dam in position the tooth is bleached one, two or three times, as necessary, and the upper two-thirds of the cavity is filled with oxy-chloride of zinc and the porcelain inlay is also placed in position at the same sitting. One case so treated seven years ago is still exhibiting good color, so good that it is scarcely a shade darker than the other teeth.

I want to thank Dr. Buckley personally and on behalf of the Society for bringing us the views of Doctors Case, Noyes, Angle and Broomell, as well as his own views on this important subject.

Dr. Carl Case.

Realizing as I do the importance of this subject and the interest it has for the orthodontist, I shall not waste time in expressing regret that I am unable to attend this meeting or pleasure that the opportunity has been afforded me to read Dr. Buckley's most excellent paper and to be heard in the discussion.

There are many facts that have been well brought out in the paper which seem to be generally recognized by us all and which have been emphasized by both Dr. Calvin Case and Dr. Angle, with whom I most heartily concur with one or two exceptions.

Beyond these facts, however, I do not believe that the evidence submitted can be regarded as conclusive.

There is good ground for believing that the upper incisors are more subject to pulp deaths than other teeth. Their prominent position lays them open to injury. They are the teeth which are probably most easily loosened in their sockets and moved, and they are the ones which usually undergo the greatest movement. The data gathered concerning the number of deaths occurring among these teeth prove the truth of the belief, and in my opinion answer conclusively the second, fourth and fifth questions.

The fourth question, however, might have been given greater scope and made to include the history of traumatism *before* regulating was commenced.

I believe that this must be considered as a predisposing cause, as the vitality of the pulp would undoubtedly be considerably lessened, which would naturally make it more subject to the inflammatory processes usually attendant on orthodontic operations in a greater or lesser degree. And the same might be said of all teeth which contain cavities or fillings, as Dr. Buckley has stated.

Concerning the third and seventh questions, I do not believe that one movement more than another is likely to cause the devitalization of the pulp, *provided* the *force applied* and the *movement secured* is *consistent* with the physiological change in structure which always takes place in the surrounding tissues. This naturally refers to good, sound teeth and not to those which have sustained traumatic injury or which contain cavities. The pulps of such teeth, as has been stated, are not in a normal condition and are more ready to respond to irritation.

The evidence of the operator who had the pulp die in a tooth which was not moved while the position of all the others was being changed, or of the man who caused the death of a central incisor by inserting tape, can be considered only in the light of an unfortunate personal experience, and, as Dr. Buckley says, the death in these cases, were the full history known, could probably be attributed to some previous injury. But certain it is that a belief that the teeth which are moved the least are the most subject to disastrous results is too inconsistent to be even considered.

The seventh question has been answered in various ways, and the reasons given are logical and well-founded, though the data furnished is insufficient to support the various beliefs as to which movement is likely to cause the most harm.

Dr. Angle thinks that a rotary movement is responsible for more deaths than any other. Very possibly this is true. But when it is remembered that rotation is one of the most common movements practiced I doubt if the proportion of deaths due to such movement, as compared with the total number of teeth so regulated, would be any greater than the deaths due to other regulative movements.

Dr. Calvin Case believes that bodily movement as a movement would have the greatest tendency of all to cause devitalization, and his belief is well founded, but I can say positively from my own observation of the numerous cases in which bodily movement has been applied that his belief is not substantiated in his own practice.

In the hands of another man, however, who was not so skilled nor so well posted in the possibilities of movement or the necessity of applying force judiciously and with great care, a different verdict would undoubtedly be given.

If such statements can be applied as evidence, then, in my opinion, it is proved that no one movement is more disastrous than another if, as Dr. Angle says, force is applied in such a consistent manner that soreness and inflammation are avoided.

Summing up, then, all the evidence that has been produced, we find that:

First. Upper incisors are the teeth which are most often affected, all others to be almost eliminated from consideration.

Second. That in a large majority of cases there was a history of traumatism.

Third. That in a number of instances there were fillings or cavities in the afflicted teeth.

Fourth. That invariably, in all instances where the appliance itself has caused no undue irritation and where the applied force has been gentle, consistent, judicious, and in keeping with the physiological change in the surrounding structures, the death of pulp must be attributed to some cause beyond the control of the operator, and I believe that in speaking thus I am voicing the sentiments of the entire Society.

Dr. Morehouse. I would like to ask a question, and also state some of my views regarding this matter, especially with reference to the elongation of the upper central incisors, we may say, at an age before the apical ends of the roots are fully developed. Is there not more danger in the elongation of these teeth at that time than at a later period, when the root has completed its full development? I have hesitated many times in the elongation of these incisors, because I have felt there might be a tendency to cause the death of the pulps of those teeth. So I have hesitated, and in most instances I have not attempted to bring about this elongation. I would like to have this matter made as clear as possible, either by Dr. Buckley or others, because it has been a continual worry, and it is an undecided point in my mind as to the best procedure in treating teeth under such circumstances.

Dr. J. Lowe Young. I first wish to thank Dr. Buckley for his paper, and particularly for that ninth question and his answer. I really think the paper would be very incomplete without that, and I am sure we all appreciate very much that Dr. Buckley inserted it. It was not intended when that letter was sent out by the secretary that Dr. Buckley should confine himself wholly to the original questions at all. He was at liberty to make any additions he desired.

The question of rotation of teeth has received some discussion, and I was much pleased with what Dr. Buckley said about the early intervention in this part of our work. The whole trend, it seems to me, of orthodontic interference is to treat cases as early as possible. I have for some time been rotating bicuspids just as soon as the two cusps are through the gum. It is not a very easy matter to fit a band on the bicuspid under such conditions, but I have accomplished it by making a number of sizes of plain bands and having them in stock, varying in size .02 of an inch in circumference. I take, say, No. 90, which is .90 of an inch in circumference, and try it on the cuspid. If too small, I take a size larger, and if too large, a size smaller, and in that way I can band those teeth when they are just emerging through the gum, and I find that a very few weeks of gentle force causes the tooth to rotate without any trouble at all, and I have also found that two or three month's retention of teeth so rotated is all that is necessary. Two or three years' retention of rotated teeth is not always sufficient when rotation is begun after root and bone are fully developed, so I believe in the early rotation of teeth.

As to the question of the death of the pulp during this rotating movement, I think that might be more likely to follow where the force is improperly applied. I mean by that, that the spur was so soldered on the band that when the ligature from the spur passed around the arch, it tended to depress the tooth, in its socket, rather than elevate it in its socket. If it tends to depress the tooth in the socket it makes it more difficult to rotate and so takes longer, and you may strangulate the blood vessels. If the tendency is to pull it out of the socket it will rotate in a short time without danger of death of the pulp.

As to the question of Dr. Morehouse, which I will answer in my way and let Dr. Buckley answer as he sees fit, it is questionable in my mind if it is necessary to elongate upper incisor teeth prior to the full formation of the root, because during the formation of the root the tooth is erupting and would tend to come down of itself. I suppose there may be rare instances where it is necessary to do it, and if done very gently I should have no fear of elongation even at that time.

Dr. Bogue. I will also make my thanks and follow Dr. Young's example in taking up question nine. I may be permitted to digress a second to say that brings us to the point as to whether such men as I should be allowed in this Society or not! Dr. Ottolengui almost comes under the same category when he so splendidly states what he would do in a given case where he found a tooth becoming discolored through manifest death of the pulp. He does something else besides orthodontia, but follows the dictates of his own conscience. I could not avoid announcing in my letter to Dr. Buckley that I knew of but four cases of death of the pulp. One patient lost the left central and lateral (upper). I never knew from what cause, but I fancy from the use of rubber bands. The patient was a child fourteen or fifteen years of age and almost a dwarf. This was fifteen or eighteen years ago, I cannot tell which, and the teeth were treated as soon as discoloration was noticed and remain now in fairly good condition, so far as color is concerned. The next case was more than thirty years ago, and the death of the pulp was not noticed for several years after the orthodontic work had been done. I never knew whether it was orthodontia that destroyed the pulp or not. That case, too, had a rubber ring on the left upper central incisor.

The fourth case had the symptoms which Dr. Ottolengui so carefully described, and the child was so good that she hesitated to let me know she was being hurt. The incisors and cuspids and the teeth that were being formed at the same time they were (two or three years of age) have never been covered with enamel, and the right central, when she came to me, had the pulp nearly or quite exposed and that died. Orthodontic work had nothing whatever to do with it, I am sure.

I have written among my notes, as Dr. Buckley went on, that rapid movement in the alveolus is not admissible, and yet you find the patient asking, "How long is this to take? When will you finish?" He who can resist such pressure without offending the patients and turning them away is, perhaps, rather adroit, and is, perhaps, able to do what some cannot do. While this rapid movement in the alveolus is not admissible except when the whole surrounding alveolus is bent or moved, that means we are carefully to consider a great many of the points which a few years ago were either not thought of at all or were passed over.

Dr. Broomell's statement, I think, merits very careful attention. He must have written that with a great deal of care, and Dr. Noyes's letter might be put down in one single word—he thinks the choking responsible—and there again we come to the fact that most of our movement is made long before the roots are formed, and ought to be, if we can possibly bring it to pass.

Dr. Case states his case so inaccurately that he does not convey much information. He thinks that rapidity of movement is the cause of death of the pulp. I think Dr. Case is teaching what is not in accordance with nature when he bands a half dozen teeth, or, in two instances, where thirty-two teeth were all fastened together. That is not in accord with nature, and that pulps will be destroyed under those circumstances is not surprising. Dr. Angle states his case splendidly with reference to the intermittent pressure, etc., yet we often see in our literature the recommendation to remove fixtures once in so often for prophylactic purposes.

I understood the President to say that he did not wish discolored teeth to come into this discussion. But I will say that many years ago the application of chlorin was advocated for a bleaching agent for inorganic substances, and iron, which is the base of the coloring matter of the blood, is not an organic substance, but is inorganic. Therefore, chlorin is entirely inadmissible, even if Dr. Kirk does use it. Oxalic acid is the proper thing, and then the pyrozone, as has been advised. Chlorin causes the tooth to become yellow and also attacks the animal matter that remains there, and thus makes the tooth brittle.

I wish to offer Dr. Ottolengui my thanks for bringing out as carefully as he did, in connection with this discussion, the behavior of unwilling patients. I am very grateful to him for bringing the subject up as he has, and the suggestion that those who will persistently tear off their fixtures might better be dismissed from our practice is a pretty good idea. Again, Dr. Ottolengui has shown unusual care, as I noted with interest, on the occasion which he reports where he redoubled his pressure and shifted the bite positively and quickly.

Dr. Hawley. There is one matter I would like to have come in this discussion, and which I have asked Dr. Buckley to discuss in closing, but I will explain myself a bit. I have been impressed by the want of some accurate and certain method of diagnosing the incipient death of the pulp, and I am in that quandary now. I have consulted, in two or three instances, with general practitioners, with uncertain results, and I would like to have some positive method of diagnosing the commencing of death of the pulp. In many instances there is a slightly blue shadow cast on the teeth by platinum bands. In one case I was so certain the pulp was beginning to die that I was on the point of drilling into the tooth. It did not respond to heat and cold as quickly as it should. I sent the case to a general practitioner, and he made some tests with uncertain results. We had a radiograph taken. There was no evidence of congestion of the pulp, and the case has now gone for two years with every evidence that the pulp is alive. I wish we had some absolutely certain method of diagnosis. I am told the Faradic current may be successfully used in this connection: that it is absolutely certain and quickly used, and, if so, it is just exactly what I want.

Dr. A. H. Ketcham. I would like to add to Dr. Hawley's question. We know that sometimes the pulp is congested, the tooth sensitive to heat and cold, and it is possible there may be a very slight change in the color of the tooth, yet if we remove the pressure the soreness disappears and the tooth sometimes resumes its normal tone. Is it possible that the pulp resumes its normal condition, or is it probable that the pulp dies without pericementitis resulting at once?

Dr. F. C. Ferris. I would like to follow the same question by asking Dr. Buckley his experience in reference to restoration of a slight discoloration? Also, the matter of giving the tooth rest, I think is important, and having the patient call at the office daily for two weeks and have the assistant run the rubber cup over the surface of the tooth to increase its temperature: a massage for thermal stimulation. That has been satisfactory in two cases in my practice. A slight yellowing of the central superior incisors was overcome by that method. I would like to know if Dr. Buckley has had any experience of that sort.

Dr. M. N. Federspiel. Does Dr. Buckley believe that a floating thrombus has a tendency to destroy the pulp of the teeth? In an operation for a cystoma the dentist reported that two lower bicuspids and the lower first molar had become devitalized. According to my thought, possibly an embolus had formed, which probably disturbed the circulation, causing extravasation necrosis. Slow methods of moving teeth will not cause devitalization of the pulp.

What is the difference between a machine and a regulating appliance? (State Board question.) I think a six-cylinder machine will destroy any tooth pulp.

Dr. Buckley. Mr. Chairman and Gentlemen: I feel that the granting permission to have this paper further discussed, by throwing it open for general discussion, has been out of courtesy to the essayist, as I am not a member of the Society. You would not have hurt my feelings by confining the discussion to the two members appointed for this purpose. Dr. Ottolengui's discussion, as usual, was so logical that I can say nothing except that I would hesitate to seal a 25 per cent. pyrozone solution in a tooth before the root is filled, and how he can do it without subsequent trouble I cannot understand. Pyrozone will cauterize the cuticle of the finger, and I would not take any chance of cauterizing the tissue of the apical area.

Regarding Dr. Morehouse's question, the instances are rare where it is necessary to elongate teeth, but in case of such a necessity I would not hesitate to do so, because of any liability to cause death of the pulp, provided the usual precautions had been taken by the orthodontist. If I had time, and if it were of interest to you (as it would not be), I would disagree with Dr. Bogue in regard to chlorin. I would not use it for bleaching teeth, but my reason for not doing so would be different from his reason. It decomposes water and we get oxygen, and the oxygen does the bleaching. We have an acid formed, and that is the objection I would have to the use of chlorin for bleaching teeth.

The main objection as raised by Dr. Hawley is the pathology associated with diseases of the pulp. How can you tell when you have overstepped the borders of physiology and entered the field of pathology? There are three diseases of the pulp with which orthodontists should be familiar, and the symptoms of which they should understand. They are active hyperæmia, passive hyperæmia, and the third, true inflammation. In active hyperæmia the pain is produced by the application of the known irritant, and when removed the pain subsides at once without treatment. Here we have the interference only with the arteries and not the veins in the pulp, and I doubt if the slight pinkish discoloration can take place in this disease. One or two intimated that they have had a slight discoloration, which cleared up after removing the appliances, etc. I do not think, if we have this pink discoloration, that the tooth would ever revert back to normal. In passive hyperæmia we have a clogging up of the veins of the pulp, and in that clogging system you have certain blood elements escaping, and this being coagulable, that pulp will ultimately die, and if you have the other disease, true inflammation, with the characteristic diapedesis of the red blood discs and coagulable material of the blood, then of course, too, the pulp must die. I am not advertising, but I have a paper before the National Dental Association on the importance of diagnosing properly. I would be pleased to see you in the audience when I read my paper next week.

Dr. Ottolengui. Just one minute to defend myself. If I left the impression that I have ever sealed 25 per cent. pyrozone in an open canal, it was due to the fact I was speaking extemporaneously. I have never done this. I do not fill the root, because you should have as extensive action of the pyrozone as possible. The extreme apex is closed before the pyrozone is used.

Dr. J. Lowe Young. I would like to ask Dr. Buckley if he would not give this Society his ideas of definite diagnosis of death of the pulp, so it might be printed with our proceedings, because I think we men interested in orthodontia are less liable to read the proceedings of the National Dental Association than the proceedings of this Society. We would appreciate it very much if he would give us that now.

Dr. Buckley. Mr. Chairman and Dr. Young: Do you want me to give the symptoms?

Dr. J. Lowe Young. How shall we diagnose whether the pulp is dying or not?

Dr. Buckley. I have briefly gone over that. The only way to make a diagnosis is by asking the patient questions and by observing the conditions. I think if you have discoloration of the tooth you have overstepped the bounds of physiology, and you have either passive hyperæmia or true inflammation. If the tooth is merely sore and the patient experiences pain, which pain is controlled by relieving pressure, or by the conditions as they are allowed to subside in a few hours, and if pain is not continuous, there is no serious disturbance of the pulp. The pulp responds to the slightest irritation; it has a marked recuperative power, however. No tissue which I know of has the ability to readjust itself more readily than the pulp tissue. If it passes the stage of active hyperæmia and if the pain is continuous and needs treatment—or even if it be intermittent—then since we have passive hyperæmia the chances are very great that the pulp will die ultimately, even though you stop your procedure at once, and in true inflammation you would be apt to have the marked discoloration, because the chances are you have the rupture of the blood-cell disc liberating the hemoglobin, and you have the pink discoloration as the hemoglobin dissolves and infiltrates the dentin. It is the pain that is the indicator, and orthodontists keep within physiological limits usually. If by accidents of some kind that point is overstepped, you there enter the field of pathology, and it is not any fault of yours, and I do not know how you can help it. If you pass the stage of active hyperæmia the pulp ultimately will die, unless it is possible the pulp may recuperate, but that is doubtful at least. It is best to remove the pulp as quickly as possible or have it removed when the reading of the symptoms indicates ultimate death. I do not know enough of the Faradic current in the diagnosis of diseases of the pulp to speak of that.

Contribution to the Knowledge of Retention in Class II.

By Herbert A. Pullen, D.M.D., Buffalo, N. Y.

In the retention of Class II the principal factor involved is the retention of the mesio-distal change in occlusion. Secondarily, however, and of quite as much importance are the factors involved in the retention of the shape of the dental arches, the change in depth of the underbite, the corrected infra or supra-occlusion, and the positions of rotated teeth.

The mechanical principles involved in the retention of Class II require the use of the buccal spur and plane, the inclined incisor plane, the plate and buccal planes, the buccal arch, the lingual arch, and intermaxillary force. Of these principles, the inclined plane, the buccal spur and plane, and intermaxillary force are chiefly concerned in the retention of mesio-distal changes in Class II.

According to definitions which the writer formulated for a treatise on retention several years ago, the inclined plane and spur and plane may be designated as occlusal retention, and the use of intermaxillary force as intermaxillary retention. In order that you may understand the writer's reasons for thus classifying these mechanical principles, a repetition of the definitions referred to may be somewhat self explanatory. Occlusal retention was defined as follows:

Occlusal Retention

"Occlusal retention is the maintenance of the normal occlusal positions of the teeth, individually or collectively, through the normal functional influence of the inclined planes of the cusps, and the contributory forces gained through restoration of arch integrity."

Although the spur and plane and inclined plane cannot be classified strictly in accordance with this definition of occlusal retention, yet if we regard all inclined plane attachments as additional or elongated tooth cusps, these mechanical principles involving the use of the inclined plane can be correctly defined under no other head than occlusal retention.

In the same treatise on retention before mentioned, intermaxillary retention was defined as follows:

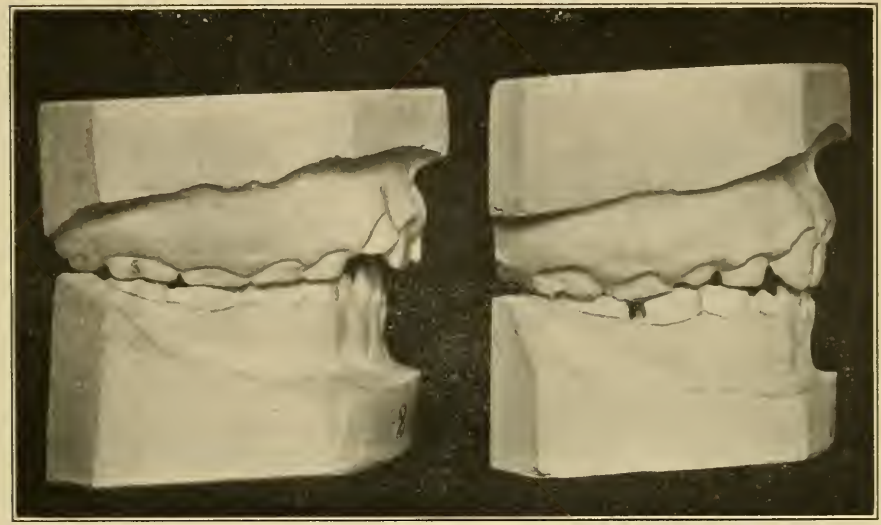

Fig. 1

Intermaxillary Retention.

"Intermaxillary retention consists of the continuation of the use of intermaxillary force in cases of mesial or distal shifting of occlusion in such a manner that a reciprocation of force and resistance is established which is capable of the retention of the mesio-distal changes in occlusion."

Considering, then, the retention of the mesio-distal changes in occlusion, there have been these two forms of retention in use, occlusal retention, which is represented by the cusp retention of molar and bicuspid teeth, or by exaggeration of cusp influence through use of elongated spurs working against each other on the principle of the inclined plane; and intermaxillary retention, represented by the continuation in use of the intermaxillary elastics.

Occlusal Retention Without Spur and Plane.

Furthermore, occlusal retention proper, or the maintenance of normal occlusal positions of the teeth through functional influence of the inclined planes of the natural cusps, can be relied upon only in a small percentage of cases, and these usually of a simple nature and of a tender age. In the first division of Class II, where there has been very little narrowing of the upper dental arch, in cases not over ten years of age, occasionally there may be found a case which responds readily to treatment, and as readily to natural cusp retention of the mesio-distal change in occlusion.

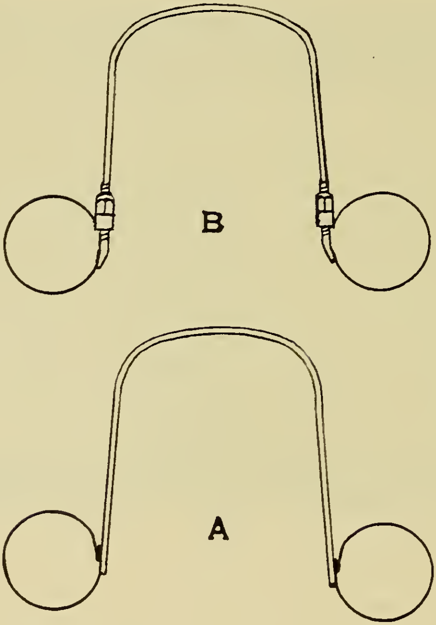

Fig. 2

Fig. 1 illustrates such a case which proved to be of the kind mentioned as requiring no artificial retention. It may be possible that the length of time of wearing the expansion arches and intermaxillary elastics has much to do with this lack of need of artificial retention, since in this particular case, nearly a year's time was consumed in making the mesio-distal change, and a great deal of development of the arches was going on during that time. There is no doubt that these cases are our most successful ones, since there is no interference with development from the retaining appliances.

In the second division of Class II, especially in the subdivision, cases are still more amenable to treatment without the need of artificial retention of the mesio-distal change in occlusion, for it seems that the expansion of the upper arch appears to provide a more secure cusp influence than in the first division of Class II.

Occlusal retention, however, without spur and plane reinforcement for Class II cases, is a very uncertain expedient, and in no way to be depended on with this difficult class of cases, for it will often happen that in the cases in which no artificial retention is provided, a return of the distal occlusion is liable to occur, necessitating a reinauguration of treatment.

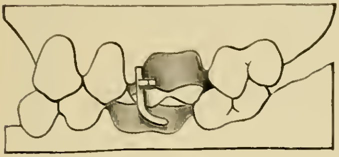

Fig. 3

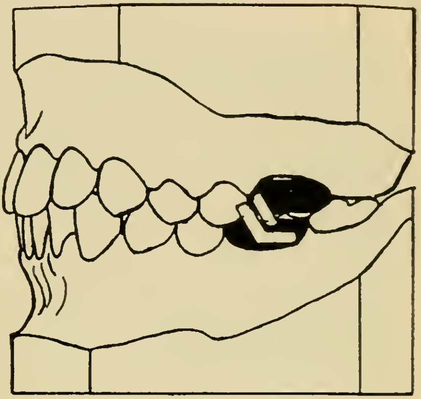

Fig. 4

Spur and Plane Retention.

The history of the spur and plane method of retaining mesio-distal changes in occlusion proves it to be admirably adaptable, when properly constructed, in some of the simpler cases, but a failure in the more serious cases. The causes for these failures have been several; first, the lack of reinforcement of the molar bands upon which the spurs and planes were used; second, the use of too thin molar bands; third, the breaking and bending of spurs through the force of mastication; fourth, the resistance or tendency to return in the more serious cases is entirely too great for any inclined plane retention.

In referring to the simpler cases of distal occlusion the writer means the younger cases in which the bicuspids, cuspids and second molars of the permanent set have not erupted, and in which the shapes of the arches are quite normal, with no infra or supra-occlusion.

Fig. 3—From Kirk's Text-book of Operative Dentistry. Cut supplied by courtesy of Lea & Febiger.

In discussion of the spur and plane method it might be stated that success with it depends largely upon the careful observance of certain details in construction, such as the use of proper bands of sufficiently strong material, and the accurate adjustment of antagonizing spurs.

As an example of the proper use of bands, if the molar clamp band is chosen to carry the buccal spurs, a lapping band should be used, the lingual screw removed, the lap soldered, and the lingual arch soldered directly to the band as in Fig. 2-A.

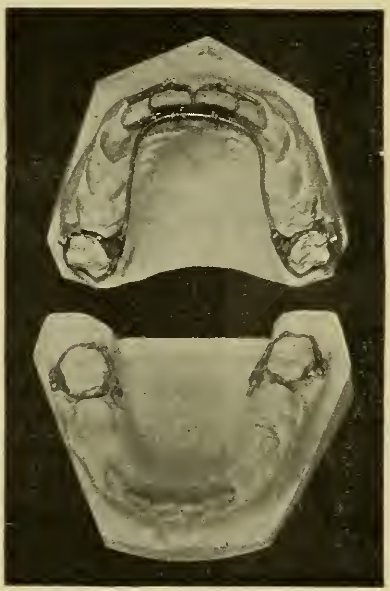

Fig. 5

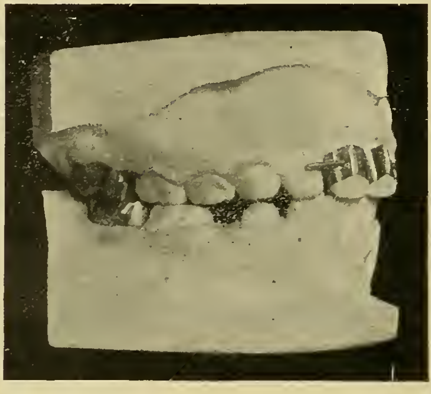

Fig. 6

The old method of using an open clamp band and soldering the lingual arch to the end of the lingual screw, as in Fig. 2-B, is mechanically imperfect, as the strain of the apparatus eventually loosens the clamp band because of the play of the lingual screw in the tube. As far as strength of band material is concerned, bands of less than 34 gauge are apt to break from the strain.

Fig. 3 represents Dr. Angle's method of adjusting the buccal spur on lower arch to the buccal plane on the upper arch. Owing to the length of the lower spur, it sometimes becomes bent or broken in mastication.

Figs. 5, 6, 12, 13, and 18 from Johnson's Text-book of Operative Dentistry. Cuts supplied by courtesy of P. Blakiston's Sons & Co.

The modification of this method by Dr. Watson is shown in Fig. 4, inclined spurs being used on both upper and lower clamp bands, each one extending about an equal distance beyond the plane of occlusion, thus allowing the use of shorter spurs which are less liable to be bent or broken.

The inclined spurs should be carefully adjusted and the attachment reinforced with solder.

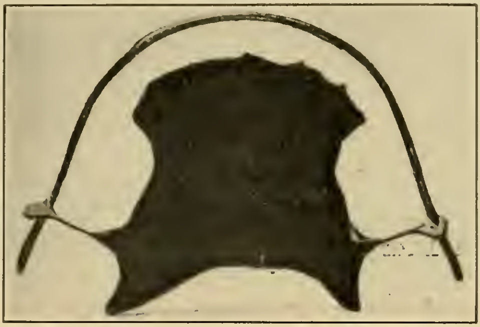

Fig. 7A

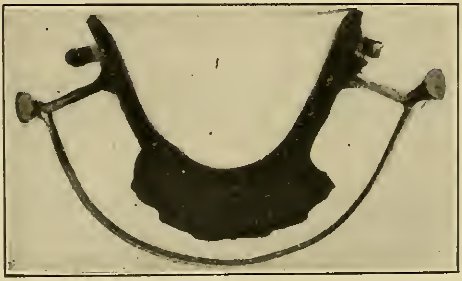

Fig. 7B

In cases of a little greater severity, though of about the same age, the spurs and planes should receive some support from the lingual arches as shown in Figs. 5 and 6.

It is apparent in Class II, Division I retention, that to retain the shape of the upper arch, especially the normal positions of the upper incisors, either a lingual arch attached to incisor bands as in Fig. 6, or a labial arch extending to the molar bands, must be used.

Removable Retainers.

Up to this time the writer has been discussing a fixed retaining apparatus with bands cemented upon the teeth, and it may be of interest to speak of the removable appliances constructed for the purpose of retaining Class II cases using spur and plane, or double spurs.

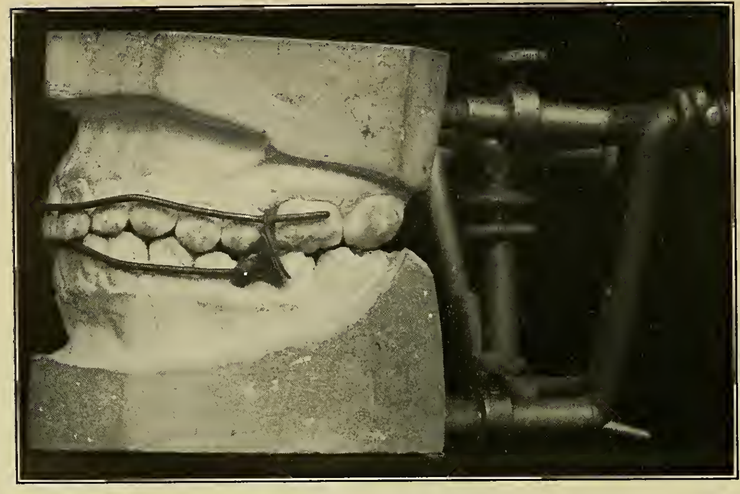

Fig. 8A

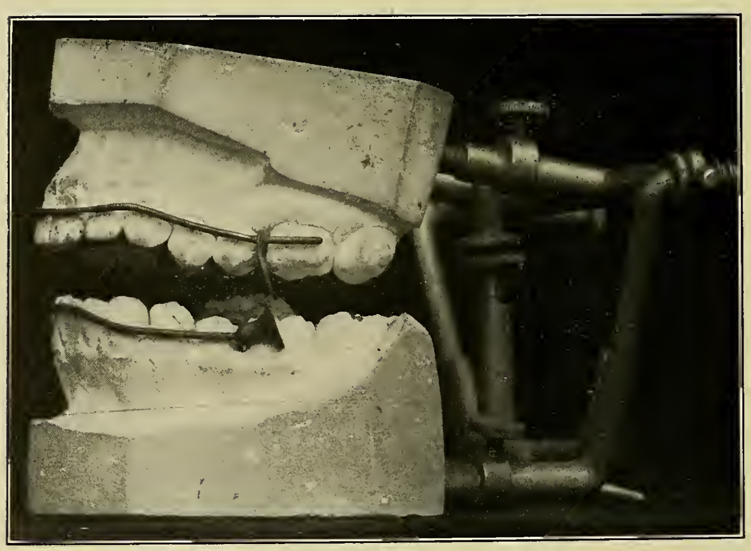

Fig. 8B

In connection therewith it may be well to state that our German confrere, Dr. McBride, of Dresden, has devised and constructed what seems to be the only practical removable apparatus of this nature for Class II, Division I cases.

This apparatus (Fig 7A and B) consists of partial plates upon the upper and lower arches connecting with labial arches by a flat piece of metal extending between the first molar and the first bicuspid in each arch, and at the point of buccal intersection of the labial wire and the metallic

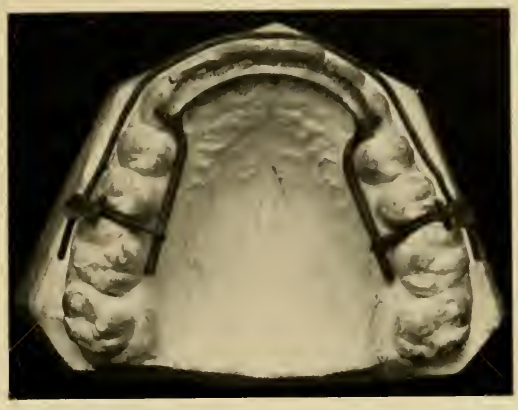

Fig. 9A

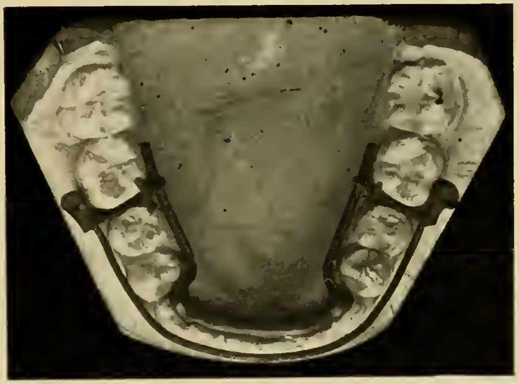

Fig. 9B

piece are fastened the inclined planes which retain the mesio-distal positions of the dental arches.

Fig. 8A and B illustrates the action of these inclined planes and the positions of the labial arches.

An improvement in construction of this appliance, shown in Fig. 9A and B, does away with the plate, leaving simply the upper lingual inclined plane attached by a lingual arch.

With this apparatus there is greater freedom of the individual teeth than with a fixed appliance, but it is impractical for use in cases in which the deciduous molars are in process of being shed, since there is no apparent means of fixation of the retainer.

Its use, then, is confined to the older cases in which the bicuspids and cuspids are erupted. The fact that it is removable does not lend attractiveness to it, even though a duplicate apparatus must be furnished for each patient.

Having briefly dealt with the methods of spur and plane retention of mesio-distal changes coming under the head of occlusal retention, so to speak, the other form, intermaxillary retention, is next to be considered.

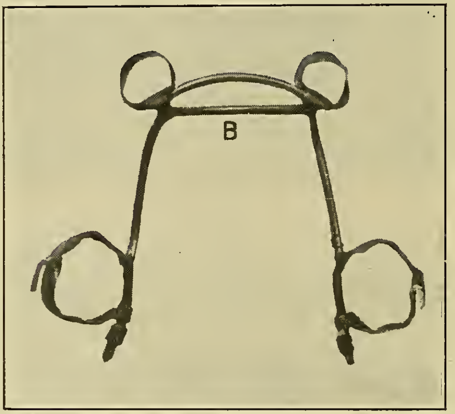

Fig. 10

Intermaxillary Retention.

In this connection Dr. Watson in 1908 presented some valuable combinations for the retention of the first division of Class II, the principle of which involves intermaxillary retention.

As illustrated in Fig. 10, the six lower anterior teeth are retained by banding the cuspids and uniting these bands with a lingual wire resting above the lingual ridge. A lingual arch is then bent to fit against the lingual surfaces of the bicuspids, resting against the cuspid bands and fitting closely under the ends of the wire attached to the cuspid bands and crossing the lingual surfaces of the incisors in close proximity to the gums. The distal ends of this lingual arch are attached to the mesio-lingual angle of the molar clamp bands with lingual screws pointing distally, and the hooks for intermaxillary elastics are soldered to the buccal surface of these bands.

The object of the appliance being thus made in two separate pieces is threefold:

1—The six anterior teeth, especially the cuspids, are more perfectly retained with a lingual wire from one cuspid band to the other than by a lingual arch attached to molar bands and resting against these six anterior teeth.

2—The teeth thus retained in sections have an opportunity to become self-supporting more rapidly than when all the teeth in one arch are bound together, as it were, by a lingual wire attached firmly to cuspid and molar bands.

3—The lingual arch, attached from molar to molar only, may result in opening the bite by allowing the molars to elongate.

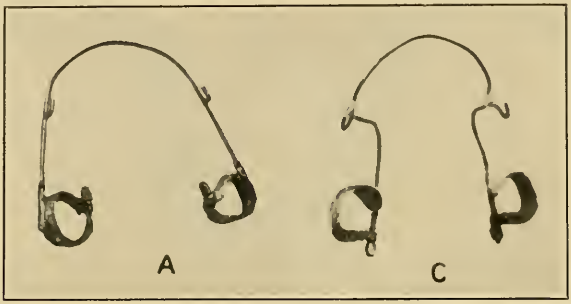

Fig. 11

The upper appliance, engaging with the lower with intermaxillary elastics, Fig. 11A, consists of a buccal arch, of 18 to 20 gauge iridio-platinum (20 per cent. iridium), sliding into close fitting buccal tubes on first molar clamp bands, a little collar soldered to either side of the arch just in front of the buccal tube, causing the pressure to be equally distributed. The intermaxillary elastics being adjusted so as to preserve a proper occlusal balance, complete the apparatus. The retention of individual teeth, such as rotated teeth, etc., is independent of this appliance.

A modification of the appliance on the upper arch, described by Dr. Watson, consists of a labial arch (Fig. 11C) around incisors attached to a partial lingual arch, passing over the arch between the cuspid and first bicuspid, and attached distally to the mesio-lingual angle of the molar clamp band with screw pointing distally. This latter appliance serves to retain expansion of the arch in the bicuspid region, and through the use of intermaxillary force, the form of the anterior portion of the upper arch, as well as the normal mesio-distal relationship. In the wearing of these appliances for the retention of Class II cases, the intermaxillary elastics may be worn at night, and after a time the elastics may be discarded, leaving the buccal and lingual arches in position to retain the form and size of the dental arches for a still longer period.

In discussing Dr. Watson's apparatus, the point was brought out that a lingual wire soldered to four bands, upon the two cuspids and two molars, for example, formed a retention that was too rigid, not giving the teeth an opportunity to become self-supporting through occlusion, etc.

In apparent contradiction to this theory, the writer wishes to present a few forms of the four band retainers which have given satisfaction in the retention of certain cases in Class II, though it is not the writer's intention to discount in any way the value of the principle of Dr. Watson's appliance.

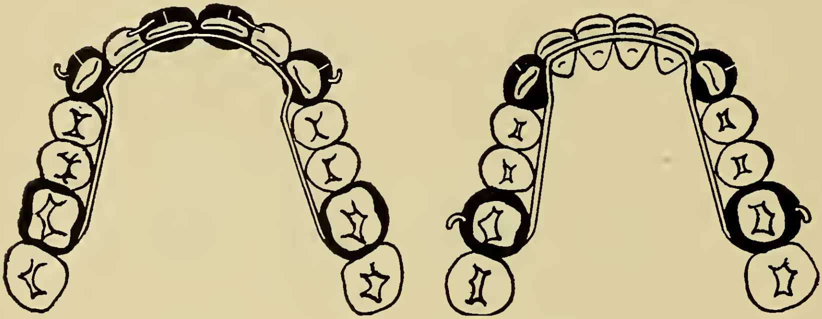

Fig. 12

Fig. 12 represents the occlusal view of an upper and lower arch, each provided with a lingual arch accurately fitted to the lingual tooth surfaces and soldered to the individual bands on the plaster model. The lingual screws were removed from the clamp bands used in treatment, the lapping ends of the bands soldered, after which the lingual arch was attached thereto as to a plain or seamless band. The plain bands upon incisors and cuspids were pinched and soldered on the labial surfaces, so that the soldered joints would not interfere with the fitting or attachments of the lingual wire.

A side view of the appliances with intermaxillary elastics in position is shown in Fig. 13. The construction of the bands in the cut is not as the writer now makes them, however; the bands should be fitted close under the gum margin as in Fig. 14, and should be made quite narrow in width. The objection may be raised to this appliance that it is too complicated, and that too many bands will prevent the proper cementation of the appliance in position. In answer to this, the essayist wishes to say that it has not proven complicated nor difficult to place in position in his own practice, in certain cases in which it is preferred to other appliances for Class II retention, as, for example, in those cases in which the underbite does not show supra-occlusion of the incisors.

A modification of the principle of the lower retainer made in separate parts is illustrated in Fig. 15. The lingual arch is soldered to the cuspid bands and extended so as to be against the lingual surface of the molar bands. Small wire rings are attached to the lingual surfaces of the molar bands and the lingual arch extended through them, a lug anterior to the rings preventing the collapse of the anterior teeth. The molars in this case have a little more individual freedom, but it is doubtful whether they can elongate as much as with the Watson retainer.

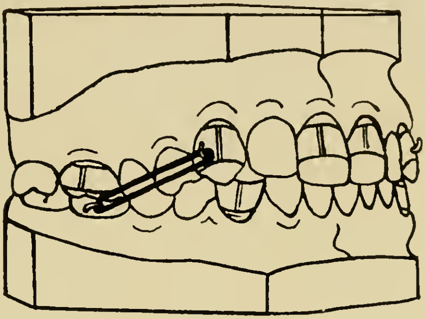

Fig. 13

Fig. 14

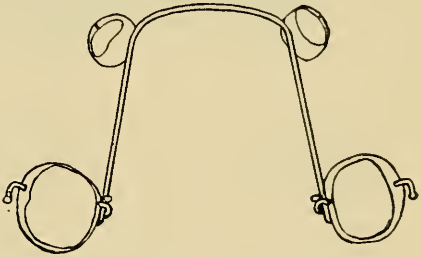

Fig. 15

Retention of Developing Arches.

Inasmuch as the cases which come under the specialist's care are often under treatment when the permanent teeth are in course of eruption, such emergencies in retention as the construction of special appliances for such cases must be provided. Fig. 16 illustrates an upper arch of a Class II, Div. I case, in which space for the unerupted cuspids had to be conserved by attaching the lingual arch to the central and first bicuspid bands, upon which latter were soldered the hooks for the intermaxillary elastics. A still younger case in which the bicuspids on one side were unerupted required a buccal extension of the hook from the lingual arch, as shown in Fig. 17.

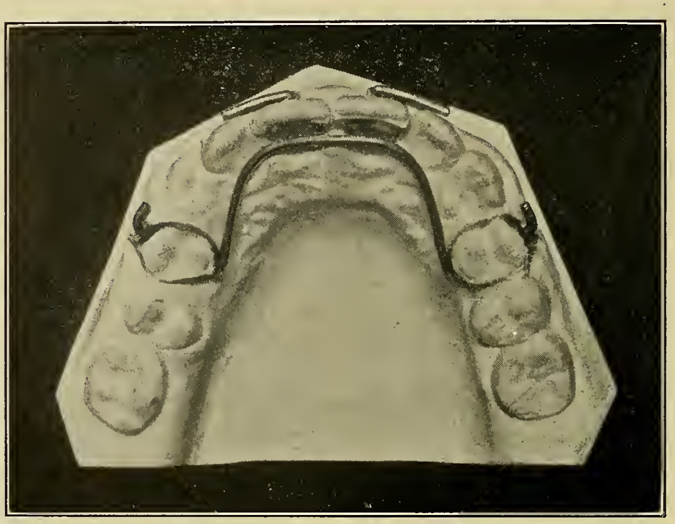

Fig. 16

Supra-Occlusion in Class II.

It is to be noted that supra-occlusion of the incisors is a feature of common occurrence in both the first and second divisions of Class II, and it is necessary to provide for the retention of the corrected anterior occlusion, at least, in these cases. For this purpose the inclined incisor plane, usually in combination with the upper lingual arch, admirably serves the purpose.

Fig. 18 exhibits such a combination of the lingual arch to which is attached Dr. Young's form of skeleton inclined plane, the intermaxillary hooks being soldered to the cuspids bands. This skeleton inclined plane has proven of very great value to the writer in the retention of incisors in cases of supra-occlusion of both Class II and Class I.

Dr. Rogers has suggested a combination of inclined incisor plane and intermaxillary force for the treatment of Division I, Class II, shown in Figs. 19 and 20. The inclined plane is a solid plane of platinum gold attached to the lingual arch, which is soldered to the upper central bands in the present instance. The intermaxillary hooks are attached to the labial surfaces of the central incisor bands, being extensions from the labial wire. The same appliance is used for the retention, except that a lower lingual arch is substituted for the expansion arch.

In constructing these combinations, the lingual arches may be made of platinum gold alloy or iridio-platinum, the bands preferably of platinum gold alloy, and the inclined plane, if it be of single piece form, may be made of 24-gauge platinum gold alloy. The lingual arches and the looped plane may be constructed of 18 or 19-gauge iridio-platinum (20 per cent.) wire.

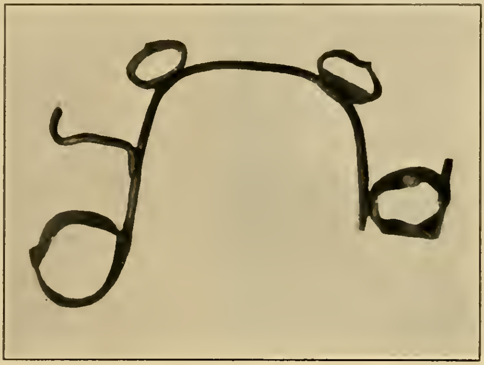

Fig. 17

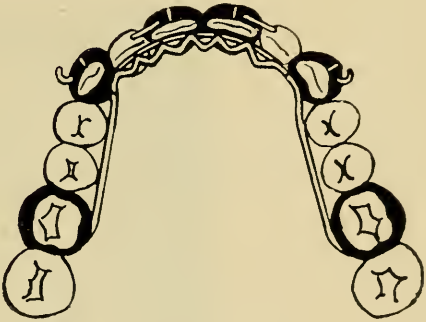

Fig. 18

The length of time for the retention of mesio-distal changes in occlusion varies, of course, with the age of the patient, the state of development of the dental arches and the severity of the case in hand. In some of the simpler cases one year is sufficient, in others two or three years' retention will not suffice, and in some cases of the more severe type a somewhat permanent retention, or one that is at least active at night for an indefinite period, seems necessary.

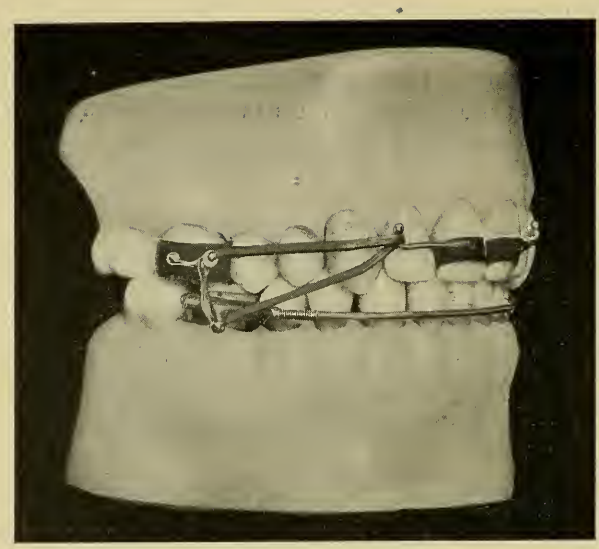

Fig. 19

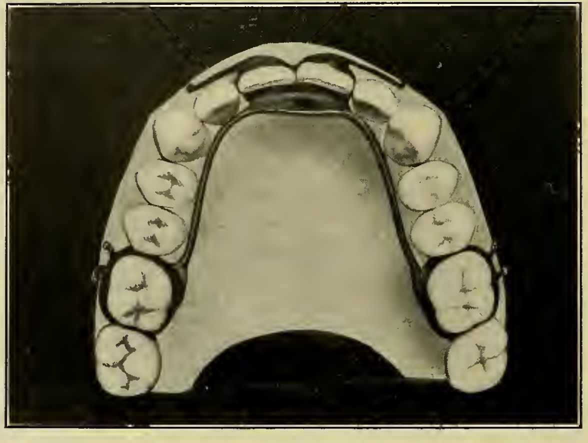

Fig. 20

Several years ago the suggestion that the intermaxillary elastics be continued for retention in Class II met with such favor in practice that the buccal spur and plane method seemed about to be discontinued altogether, and now, after a trial of the intermaxillary retention, many are asking themselves whether or not the action of the elastics is not prejudicial to, or preventive of, the fixation principles of retention and therefore inhibitive of the best results of treatment.

The intermaxillary retention seems particularly adapted to the mouth-breathing cases of the first division of Class II, since the elastics serve the double purpose of retaining the mesio-distal change in occlusion and of holding the mouth closed.

It has been claimed for the intermaxillary retention that the continuously acting force keeps up a gentle stimulus to growth of the dental arches. The buccal spur and plane method serves only to retain the mesio-distal change in occlusion, and in the writer's practice its use is limited.

It is true that fixation of several of the teeth in each arch by lingual arches and bands tends to retard development, but in these cases in which development is most rapid, a short length of time for retention offsets this objection, and in the adult cases the period of development is so near complete that the fixed retention with the lingual arches and the use of the intermaxillary elastics is not objectionable.

Discussion of Paper by Dr. Pullen.

Dr. Lourie. I do not know of any more practical subject for discussion than that presented by Dr. Pullen. Doubtless all of you, like myself, have some satisfactory methods of retention; the majority of us, however, expect difficulty in Class II cases. One of our members remarked yesterday he guessed he would specialize with Class I and Class III cases, leaving out Class II! (Laughter.)

Dr. Pullen has pointed out that the two principal plans of retention involve artificial occlusal retention through the occlusal spurs, and intermaxillary retention by means of the Baker elastics. But so much time was taken up in explaining appliances that it rather detracted from the importance of knowing when to use the various forms of retention. The difficulty I have had with the occlusal retainers has not been entirely from the force of mastication, nor entirely from the weakness of the appliances themselves, although I have had the same difficulty that Dr. Pullen has had in the occlusal spurs being broken and bent, and the teeth tipped and twisted from the force of mastication. But the greatest trouble has been from the antagonistic muscular pressure at night. The appliances may prove very effective in the day time, but at night the tendency of the muscles to revert to the old habit causes a greater strain. Consequently, I would not think of using occlusal spurs in any case without some such support as a lingual arch, and extensions to prevent tipping of the molars, etc. I think Dr. Watson's paper, referred to by the essayist, brought out clearly the advantages of the intermaxillary elastics in retention.

The point of consuming a longer time than is customary in bringing about the restoration of normal mesio-distal relations in Class II cases is important. Intermaxillary elastics more nearly take the place of restored muscular action than do occlusal spurs. Occlusal spurs create an unnatural condition, which the muscles start to antagonize, whereas with light intermaxillary elastics the action is more nearly like the muscular pressure. In Division II, Class II, you have more natural muscular action than in Division I. In Division I there is a lack of proper muscular function in the muscles of mastication and in the muscles of the lips, and in Division II there is more natural muscular pressure of all of the muscles.

Discussing appliances, I would not wish to give up a well fitted clamp band for a plain band because I had difficulty in the clamp band loosening. I think the main reason for the loosening of a clamp band when the lingual arch is attached is in the soldering of the head of the screw post to the clamp band. It is not in the right place. The clamp band as usually sold in the market, when tightened up, leaves the head of the screw post at about the middle of the lingual surface of the tooth, and any twisting motion pulls one edge of the band away from the tooth. By using a larger clamp band, and having the screw post soldered well back towards the distal angle of the tooth, any twisting on the screw post will be at right angles with the perpendicular portion of the band here. You may let the cement flow in between the screw and the short tube, and such a clamp band is practically proof against any ordinary strain on the lingual arch. There are some objections to having the nut in this position, on account of affording a place for the accumulation of food. That is one of the principal objections to the use of the clamp band, of course.

Dr. Pullen suggested that some doubt has arisen as to whether or not the continued action of the elastics may not prove prejudicial to the fixation of the teeth. If so, it is because too heavy an elastic is used for continuing the retention. If you follow Dr. Watson's suggestion and use very light elastic, and then continue with even a less pressure, all would be well. I make a habit of testing from time to time as to whether the patient is able to bite backward. A too heavy elastic may destroy the whole occlusion sometimes, whereas a light one would answer the purpose splendidly.

Wherever it is possible to attach a lingual arch with a loose joint instead of a soldered joint, do so. If you can attach the lingual arch by tubes soldered to the ends and slipped over the screw post, it is much better, and allows the bucco-lingual tipping of the anchor teeth to induce a normal occlusion of the molars, and the teeth will settle down much more quickly into their normal occlusion relations than if the bands are rigidly attached. Wherever it is possible, I should even prefer having attachment to the bicuspids or cuspids instead of the molars, because if your retention causes a little tipping or twisting of the bicuspid teeth, it does not affect the whole occlusion as much as in the slight tipping of the molar.

Dr. Dunn. Dr. Pullen, in the beginning of his paper, gives as the principal factor involved in the retention of Class II the mesio-distal change in occlusion. Secondary, is the shape of dental arches, the change in the depth of the under bite, the corrected infra or supra-occlusion, etc. It seems to me that if the doctor had included in the principal factor the change in the depth of the under bite, he would have been more nearly correct; for in the largest percentage of the cases coming under this class, it would matter but little how long the mesio-distal change was retained. Without the change in the vertical length or height of molars or bicuspids, permanency would be out of the question.

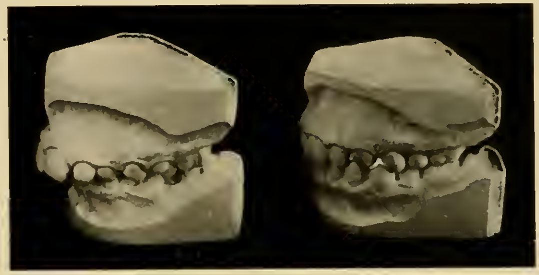

Fig. 21

This vertical change is as much a principal factor in retaining Class II as is the mesio-distal relation. In fact, in my own mind, I believe it to be of more importance; for the opening of the bite brings about a change in the temporo-mandibular articulation, which greatly facilitates the bringing about and maintaining of this mesio-distal change, and explains in the case presented by Dr. Gray the reason for retainers not being necessary.

Many cases could be cited wherein during treatment of expanding arches, and the rotating of teeth, the vertical length of bicuspids and molars had increased to the extent that the normal mesio-distal relation of the jaws had taken place otherwise, unaided, and the retention of this new relation was unnecessary.

The case shown (Fig. 21) is another such as that presented by Dr. Gray, and if you will study it closely you will note that the vertical lengths of the bicuspids and molars have increased considerably, although no special effort had been made, mechanically, to bring it about. The only retention being used is a little vulcanite plate to sustain the expanded lower arch. The age of patient was eleven years, and the treatment covered a period of ten months.

I agree, however, with the essayist, that such retention of Class II cases should not be depended on, and that a re-enforcement of normal occlusal retention of some sort should be used.

I cannot too strongly commend Dr. Watson's idea, with some modification, in his retention of Class II, for it comes the nearest to being like Nature's forces that maintain normal occlusion, with a removable appliance of any practicability, yet given us. It allows of greatest latitude in individual tooth settlement, and, at the same time, is most effective as a retainer of cases of this class. It is hygienic, and when thoroughly understood, properly made and adjusted, the result obtained is gratifying indeed.

The modification I speak of is in connection with the upper retainer. The screw-post should be allowed to remain, and the lingual arch adjusted so that a short tube on the end of the arch will engage this screw-post, with the lingual arch at the anterior portion resting at the gingival line. Often in these cases we have a condition where there is rotation of the bicuspids. In order to prevent this arch from dropping down, a band on these teeth may be used, to which is soldered a half staple, to engage the arch. Where bicuspids have not erupted, central incisors may be used. In that case, the seam of bands is allowed to extend so as to engage the labial arch that they may not be forced into supra-occlusion.

In the wearing of the labial arch, I prefer a little play in the buccal tubes, having it so adjusted that it touches on the lower third or occlusal edge of the four incisors. Where we have a lack of development, the pressure at that point, when the lingual arch is properly adjusted, will bring about the needed development very rapidly.

The lower lingual arch is attached in the same manner, and you can use bands either on the incisors or cuspids, utilizing the same principle of staples, making them long enough so that you can, if you choose, bend them around the arch so as to keep it in good position. The arches are easily removed for cleansing, and I think it is the nearest to a perfect retainer for Class II cases yet devised.

It has been my experience that, where hooks are attached to upper cuspids or laterals for the reception of intermaxillary ligatures, the pressure of these ligatures interferes with the proper settlement of the teeth distal to hooks, and especially so if they are in the course of eruption. Dr. Watson's idea of using the labial arch overcomes this difficulty.

It matters little how skilful the operator, nor how perfect his appliance may be, he will be unable to so apply his force during treatment as to avoid all tipping of the teeth, and for that reason a fixed retainer other than a temporary device is impractical in obtaining ideal results, interfering as it does with the settlement of the teeth so fixed.

If we will but study the development and position of the roots of these moved teeth, their approximation or close relation to one another, and the necessity of their assuming their normal positions at the earliest possible date, in order to obtain the bone development that Nature planned for this particular type of individual, and giving the best results in facial outline and permanency, we will see at once the impracticability of the fixed retainer, other than as I have stated before—a temporary affair to be worn for a very short period.

Dr. Ottolengui. I would like to ask Dr. Pullen and Dr. Dunn what they mean by the "under-bite." I am willing to exhibit my ignorance if I can gain enlightenment.

Dr. Dunn. I used that term because at the time I could not think of any other term to express the idea, and partially because Dr. Pullen had used it.

Dr. Pullen. I used the terms "supra" and "infra" occlusion, etc.

Dr. Ottolengui. I will ask Dr. Pullen, then, what he meant by saying that he uses the inclined plane to correct supra-occlusion in Class II. What supra-occlusion does he correct in such cases?

Dr. Pullen. I have corrected supra-occlusion of incisors a number of times, if there really is any such thing as supra-occlusion of the incisors in Class II. If there is a supra-occlusion in Class II, we may correct it by driving the teeth down in their sockets as Dr. Lourie says he does. As a matter of fact, I still believe what I have always said, that there is no supra-occlusion of incisors in Class II, but an infra-occlusion of the molars and bicuspids. The inclined plane retains the forward position of the teeth, and allows the elongation of the bicuspids and molars. If they do not elongate the orthodontist must do something to make them.

Dr. Federspiel. Does not disuse have a tendency to elongate teeth?

Dr. Ottolengui. Not to my knowledge. I do not deny it, but I have never heard of it. Loss of occlusion through extraction of antagonizing teeth is a different thing entirely, but the over-eruption of the lower incisors has not yet been proven to have occurred.

Dr. Morehouse. Regarding the placing of hooks for intermaxillary retention, on the distal part of the lower molar bands instead of at the mesial, I would like to understand what the advantage is.

Dr. Pullen. That was a mistake in the drawing for the lantern slide. The hooks should be at the mesial angle of the lower molar band.

Dr Bogue. I think Dr. Ottolengui has done us a service in calling attention to one or two weak points in the language used. I offer my thanks to him. There are two or three things in Dr. Pullen's valuable paper about which I wished to ask questions as he went along. One is this: If he is dealing with the case of a patient, we will say fourteen, fifteen or sixteen years of age (I am careful to specify), who has a distal occlusion of the first permanent molars, and uses an apparatus on the teeth so fixed that he can advance the first bicuspids, then the second bicuspids, and then, holding everything firmly, advance the lower molars with the intermaxillary band until he gets a correct occlusion of the principal molars,—have you not got such a relation of the permanent teeth as to meet the conditions which I understood you to describe, where the teeth were held by their own inclined planes?

Dr. Pullen. To a certain extent, yes. There is a tendency towards a return of the abnormal condition in so many cases as to interfere with the blind following of the theoretical hypothesis suggested by Dr. Bogue.

Dr. Bogue. Is there such a tendency if you have absolutely moved your teeth? As I have understood Dr. Dunn, he spoke of an inevitable tipping. I do not assent to that at all. I do not believe the tipping of the teeth we are moving is at all essential to their proper placing in position. They do tip with the apparatus you buy ready-made with horizontal tubes soldered rigidly to the bands.

Dr. Dunn. They tip with any apparatus.

Dr. Bogue. I beg your pardon; with the Ainsworth apparatus they do not tip, and with the Kemple square tube they do not tip.

Dr. Young. You are talking about buccal tipping. Drs. Dunn and Pullen mean mesial tipping.

Dr. Bogue. That is a horse of another color. When we obey Dr. Watson's caution to move teeth slowly enough anteriorly, we will not have mesial tipping either, because by the process of spreading with the Ainsworth arch, or with vertical, or even with square tubes on the bands, we will hold those teeth upright until they shall have assumed the proper relations occlusally, and the cuspids will then do what Dr. Pullen so graphically described—hold each other in position. Dr. Baker's brother was brought to me at ten years of age, and Dr. Baker's father and myself continued to differ over that boy, and at the last discussion we had I said that the boy's teeth would return to a proper position when the retainers were taken off. In the course of a few months, the retainers having been removed, the teeth, by the action of the tongue within and lips without, had assumed an ovoid position which they did not have at all before, and Dr. Baker recognized that as quickly as I did, and sent me models of the case. My point is this—that Dr. Pullen retains too much! I saw a case of Dr. Ainsworth's four or five months ago, and I wrote to him at once that the patient had consulted me, and asked me what I might do. After obtaining permission from Dr. Ainsworth, I cut off the appliance, and the teeth went back considerably and settled where they belonged.

Dr. Ottolengui. I would like to say a word. I did not mean what I said previously as a criticism. I simply wanted to call the essayist's attention to a misadvertence on his part in the use of terms, and I hope that by having done so his true meaning is now more clear. As to the use of intermaxillary force in retention, I believe that we need not be at all alarmed about using continuous intermaxillary force in retaining Class II or Class III. I do not believe it is as easy to move a lower set of teeth forward by intermaxillary force as it is to move the upper arch forward, and for this reason, if you are treating Class III, and you have intermaxillary elastics attached at the molar region in the upper arch, and the cuspid region in the lower, you have practically a stationary anchorage in the lower jaw, because it is practically impossible for this elastic to move the entire lower arch backward, and the stress of the elastic will be almost entirely expressed in moving the upper arch forward. On the contrary, in Class II, with the elastics attached reversely, the more or less stationary anchorage is in the upper jaw, and the elastics exert a stress which some patients will be inclined to relieve by protruding the mandible. Thus we do not express exactly the same degree of force with the same size elastics in Class II as in Class III. We get almost the full stress of the elastics against the teeth in Class III, but there is a more complex relation in Class II; perhaps that is an advantage, because it is desirable to move the mandible as well as the teeth.

If a Class III case be corrected prior to the eruption of the second molars, I believe that intermaxillary force is an absolutely essential factor in successful retention. I more than ever believe that in Class III we have to deal with a lack of development of the upper arch, and, indeed, of the entire superior maxillary bones. Some believe that there is an over-development of the mandible. This I doubt, except in very rare cases, and in these the mandible is over-large rather than over-developed; a monstrosity rather than a pathological overgrowth. But at least we have to reckon with a maximum, or normal growth of the mandible, against an abnormal lack of growth of the maxillary bones. In many such cases, with the eruption of the lower second molars there is a recurrence of the apparent protrusion of the lower anterior teeth, and many operators have been chagrined, thinking that their retention has not held, and that the upper arch has slipped back. This, I think, has not been a true reading of the facts. From a careful study of two cases, each of which has been in my care for five years, I believe that with the eruption of the lower second molars, we have the normal horizontal growth or elongation of the mandible and superimposed arch. Coincidently we should have an equivalent development of the upper arch, if the newly established normal occlusion is to be maintained. Unfortunately the same mysterious factors which originally caused the bone cells of the maxillæ to build more slowly than those of the mandible are still existent, and therefore the upper arch fails to develop as rapidly as the lower, and we have Class III malocclusion reestablished. Intermaxillary retention, therefore, is obligatory, since it supplies just that mechanical stimulus which will cause a continued forward movement of the upper arch, sufficient to keep the upper teeth in normal occlusal relations with the more rapidly developing lower arch. If the above hypothesis be correct, it follows that retainers and elastic force must be continued until the eruption of the lower third molars. There is, however, one other recourse which I am very desirous of seeing tried. In one case in my practice, where an over-large mandible is a family trait, I would like to have an operation performed, and the unerupted third molars removed, because in this way I believe that we may check the further anterior movement of the teeth in the lower arch.

Dr. Fischer. I would like to make one suggestion to aid Dr. Ottolengui and Dr. Pullen in their "under-bite" discussion. I would suggest the term "occluso-gingival relation of the two planes." Each arch has an occlusal plane, and there is an occluso-gingival relation if I may so term it, and I think that is what Dr. Pullen had reference to.

I would say to Dr. Federspiel that, instead of saying "disuse," he should use the term "abnormal use."

Dr. Weeks. My point of view of the treatment and conditions of Class II differs too far from the point of view of the essayist to make it worth while to enter a discussion of a five minute limit. As you all know, I think the position of the condyle in the Glenoid fossa should be considered in the retention of all Class II cases. There is one thing in relation to the over-bite, or the inequality between the distance of eruption of the anterior and posterior teeth, which is a vital factor. I think the inequality between the extent of eruption of the anterior teeth and posterior teeth, and the failure to meet these conditions, has been, in many cases, the factor which has caused the greatest share of difficulty in the retention of the cases, and has been the chief factor in the failures of the treatment in Class II.

Dr. Pullen. The discussion of this paper proves that the subject is too broad for any one man to bring out all the points in connection therewith. I take off my hat to any man who is an authority on Class II retention. At the same time, when I was asked to write the paper, I thought I would endeavor to bring out some of the history of Class II retention to date, and some of the general principles involved, expecting that many points of value would be brought out in the discussion.

Referring to the discussions of Doctors Lourie and Dunn, I feel much indebted to them for bringing out those very points which I omitted, especially the point Dr. Lourie made as to the intermaxillary elastics taking the place of the muscular disability.

The superiority of the clamp band over the plain band for molar bands in Class II retention is a point I omitted, but intended to mention in the paper. If the lapping clamp band is used, there is a better chance for the band doing efficient work than if we use one without the lap, because the band and cement completely encircle the tooth, thus affording better protection. The clamp band is also not nearly so liable to become loosened as the plain band.

Dr. Louri fastens the end of the lingual arch around the distal angle of the molar band to get rid of the strain, which is a decided advantage.

There is a place, however, for the plain band, especially for very young children, where we want to get rid of everything that interferes with the action of the tongue, or of all roughness which may catch particles of food, etc.

I wish to compliment Dr. Dunn on the beautiful result obtained in the case shown. I do not think I have ever produced a similar result and do not know of any similar case that was not retained artificially. I may, as Dr. Bogue says, over-retain my cases, and it is probable that some of our cases might be all safe if we would allow the normal occlusal forces to take care of them after a shorter period of retention, but I have felt the necessity of being on the safe side and have retained Class II cases a long time.

Regarding the questions of Dr. Ottolengui, I was slightly confused because I thought he was springing something in the nature of an ambiguous catch question. I believe, with Dr. Ottolengui, that the infra-occlusion of the bicuspids is in evidence, although I think we may also have some supra-occlusion of the incisors; but I have no doubt that in the majority of Class II cases the greatest trouble is in the infra-occlusion of the bicuspids and molars.

The Use of the Inclined Planes in the Correction and Retention of Mal-Occlusion.

By Alfred P. Rogers, D.D.S., Boston, Mass.

Observations regarding the causes of mal-occlusion during the past few years have led me to believe that the lack of vertical development of the molars and bicuspids is a most important factor in the development of mal-occlusion. Consequently, what I wrote two years ago regarding mal-development in the molar and bicuspid region can be quoted to-day with even more conviction.

"During the period of transition, between the loss of the deciduous and the complete eruption of the permanent teeth, there is a gradual growth of the face in length, breadth and depth. The length is influenced very largely by the increased vertical development of the teeth and their processes. It is during this period, in normal cases, that a new and correct occlusal plane is developed; but in those cases where abnormal influences are introduced, there is a destruction of occlusal balance frequently resulting in mal-development of the occlusal plane. If the incisors are allowed to develop unhampered, they reach their correct occlusal altitude, but when influenced by retarded development in the premaxillæ, from whatever cause, they are prevented from reaching their typical positions. The same is true in the molar and bicuspid region."

My attention has been directed to mal-development in this region, not alone among my own patients, but in numerous cases among patients of other orthodontists. I have not been able to find reasonable explanation why normal development does not take place in this region at the proper time.

A Possible Etiologic Factor in Class II.

Reflections upon this condition convinced me that many Class II cases, following normal deciduous dentitions, have their cause in this lack of vertical development. Perhaps your observations may deny this proposition, but having seen some interesting and convincing mal-developments, it is hard for me to abandon that idea. It may be well to describe a case in which mal-development is seen to progress. Take a normal, healthy child, age five, and watch the development. The deciduous denture is normal. The eruption of the lower central incisors occurs, followed by the eruption of the upper central incisors; the process continues unhampered, and these teeth soon reach their proper altitude. They remain in this position, and the four lateral incisors develop in like manner. Now we will observe that the incisors gradually overlap until the lower ones are completely hidden from view. (Fig. 1.) We cannot by any argument covince ourselves that this is a supra-occlusion at this early age. For some reason the vertical development which should now be in progress in the lateral halves fails to occur, and the first molars, together with the temporary molars, are seen to occupy a plane much lower than the incisors. As these incisors glide past one another, the cutting edges of the lower come into contact with the lingual inclined planes of the upper incisors, which force tends to throw the lower arch into a distal position, thus hampering its further development. This primary inclined force has soon many allies in the numerous inclines of the other teeth. It will readily be understood that if

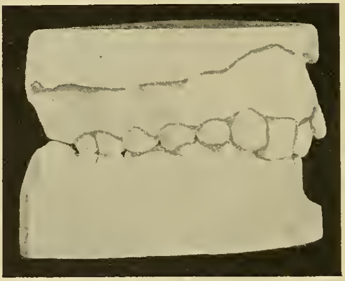

Fig. 1.

inclined planes will produce this condition of mal-development, an artificial device of the same mechanical principle, *properly adjusted*, may well be used to assist in establishing the normal relations.

Use of Inclined Planes.

In writing of the use of the inclined planes and bite planes in the correction of mal-occlusion and in retention of corrected cases, consideration will first be given to that class of cases most liable to be benefited by this form of appliance, with special reference to the general principles involved. The mode of application, together with a consideration of the technique, will follow. It seems fitting to pursue this course rather than to lengthen the paper by giving any space to the history of its development. It might be well to say, however, that the inclined plane and bite-plate have long been known as being of value to the orthodontist, and their use has been quite general.

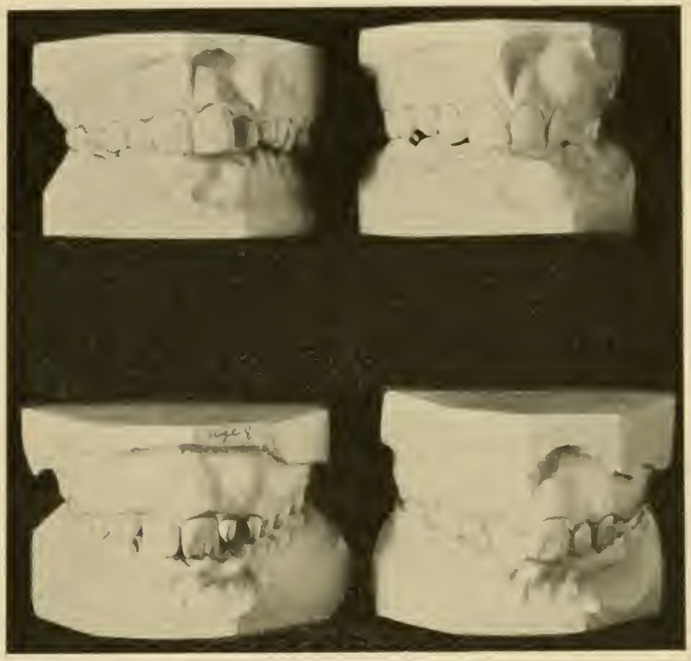

Fig. 2.

Kingsley, I believe, was the first to use the device known as the inclined plane, to "jump the bite," as the correction of distal occlusion was termed at that time. Dr. Ainsworth has been an advocate of the inclined plane and has developed its usefulness to an important degree.

Although the inclined plane has long been used for the correction of mal-occlusion, its application has been so frequently misinterpreted and its construction so faulty that there have been many failures following very promising first results. It is my object to describe as nearly as possible the construction of the apparatus which in my experience has proved most valuable.

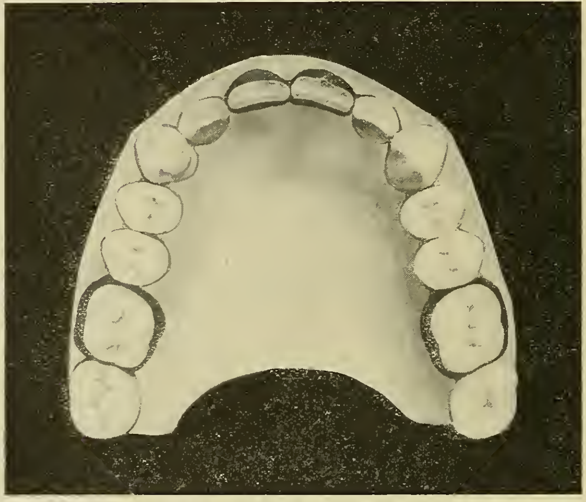

Fig. 3.

Doubtless many of you will call to mind cases that have come under your attention, which, while confining yourselves to the usual methods of treatment, have given considerable difficulty regarding the adjustment of the occlusal plane. The principal symptom will be found in the excessive overbite in the incisor region.

The illustrations will show that class of cases (Fig. 2) which I have found yielded most satisfactorily to correction by this method. The appliance such as has been used in the treatment of these cases is not intended for primary use; but is confined to the secondary stage following the usual line of treatment up to that point where the arches are placed in their proper shape and size. The appliance should be restricted more to that period of retention and may therefore be termed an active retainer, since natural development takes place while the patient is wearing it.

Although these appliances may be used during various ages, I have found that between the ages of 9 and 12 is the field of greatest usefulness, because it is between these periods that the developing bicuspids and molars can be used to the greatest advantage, and where results will surely be more permanent, due to the natural development and tissue deposit which takes place at this time.

It will be readily understood that the first requisite in preparing the mouth to receive this appliance is that the upper arch shall first be placed in its proper shape and size, and that the first molars and the two centrals shall be in their true relation, this being accomplished in the usual way. In doubtful cases, when the treatment has progressed far enough to show that an overbite is inevitable without depressing the incisors, and that the occlusal plane needs readjusting, it is then time to resort to the appliance.

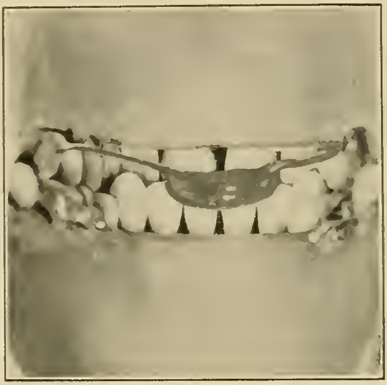

Fig. 4.

Construction of Inclined Plane Appliance.

When, as just stated, the arch is of the proper shape and size, and the first molars and centrals in good relative positions, bands are made to fit the molars (in many cases the bands which are used in the preliminary treatment may be used). McGill bands of gold or platinum are fitted to the central incisors (Fig. 3). My favorite material for this work is coin gold rolled down to about 32 or 33-gauge. The width of these bands depends largely upon the degree of stress which you expect the appliance to withstand. After these bands have been thoroughly well burnished to the incisors, a plaster impression is taken and the bands removed from the teeth and placed in their respective impressions. An accurate impression of the lower arch is also made, together with an accurate bite showing the correct overbite desired for the particular type of case which you are treating.

These models are then placed in an articulator in the relation indicated by the bite. Next in order is the construction of the bite plane, which I prefer to make of platinum-and-gold clasp metal, gauge 22. In general shape this plane must be made so as to *engage the lingual surface of the four lower incisors* when the teeth are in occlusion. (Fig. 4.) After it has been accurately fitted to the lower incisors it is placed on the lingual side of the bands on the upper incisors and held in place with sticky wax. Eighteen-gauge gold clasp-wire is then carried from the molar bands to the incisors under the bite plane. The mesial ends of the labial hooks are flattened before they are placed in position overlapping the seam. This insures greater strength. These hooks may be made any shape or length required

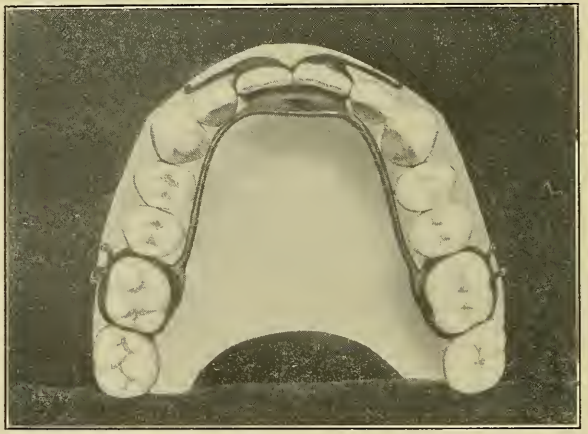

Fig. 5.

in the given case. Place hooks on the buccal surfaces of the molar bands directly over the mesio-buccal cusp. After these have been accurately placed and secured with sticky wax, the model is invested so as to leave all waxed parts exposed. When thoroughly dry, the appliance is ready for soldering. This must be done with the greatest care, and the use of sufficient solder to make the appliance strong in every part. Always allow the solder to flow between the incisor bands. When the appliance has been thoroughly cleaned and polished it is ready for application (Fig. 5). This should be attended without pain or discomfort to the patient if the work has been carried along and each step done with care.

It is always advisable to slip the appliance on the patient's teeth, allowing it to remain for some minutes in order that any difficulties might be discovered. If found to be perfect, it is carefully removed, dried, and the patient's mouth prepared for the cementing. The teeth are first thoroughly polished and dried with alcohol. The assistant mixes enough cement to not only fill all four bands, but to cover all four teeth with a sufficient supply. A hydraulic cement is preferable, as it is almost impossible in some mouths to keep the appliance dry for a long time after insertion.

When the appliance is carried to its place, the patient is allowed to bite firmly, assisting the operator in making a proper adaptation. Careful examination is made of all points to see that each part of the appliance has been carried home to its proper position.

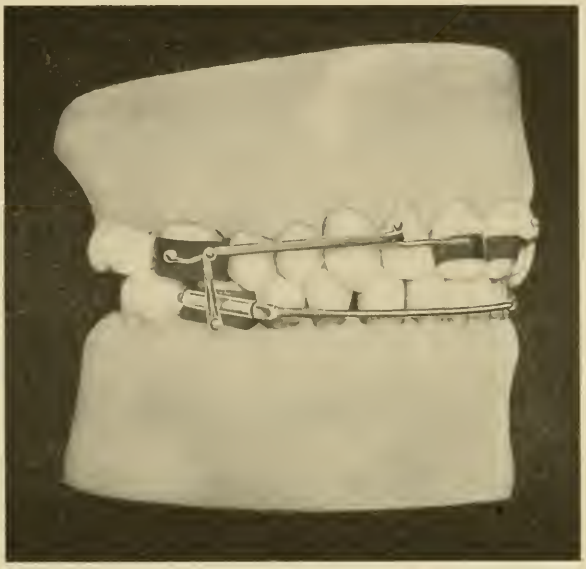

Fig. 6.

The operator's attention is now turned to the condition of the lower arch. If there has been much opening of the bite, light intermaxillary elastics are applied in order to elevate the molars and bring them into occlusion. In cases where the bicuspids are just developing, no attention need be given them until they have erupted far enough to be carried into precise occlusion with the fellows of the opposite arch. The intermaxillary elastics are worn continually with this appliance for the first few months following the application.

Figs. 6 and 7 show views of the completed apparatus in position. Also the manner in which the intermaxillary elastics may be applied in order to effect the different movements.

Cases from Practice.

Fig. 8. This is from a boy, 11 years of age, in which there was an entire lack of vertical development of the lateral halves. The case was perplexing, and I cannot see how it could have been successfully treated except by the method employed. The figure on the left shows the casts made just before the eruption of the bicuspids. The lower incisors were making their impression upon the rugœ. The occlusion was completely distal. The casts on the right show the same case about eight months after the beginning of the treatment, and about five months after the application of the appliance. When this appliance was first adjusted, the occlusal surfaces of the molars were one-eighth of an inch apart.

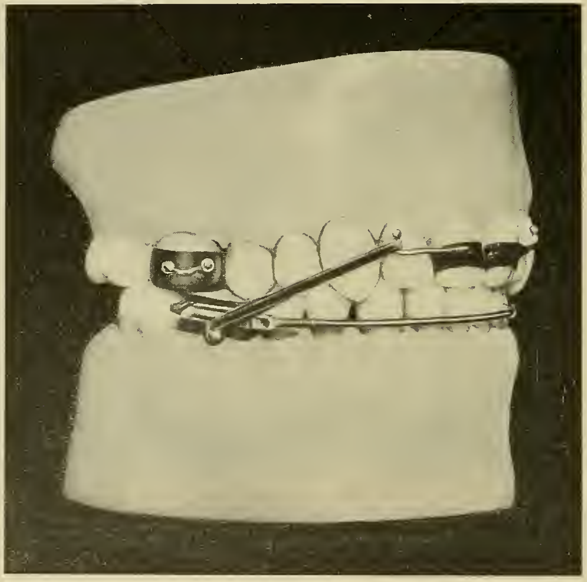

Fig. 7.

They have now come into precise occlusion, and you will observe that the bicuspids and cuspids are gradually coming into a good occlusion without any assistance whatever. Some of the bicuspids are slightly rotated, but these, being minor faults, can be corrected when they have erupted sufficiently. The appliance has been removed from the lower arch in order to better show the erupting cuspids.

Fig. 9 shows a Class II case in which this principle has been carried out with extreme satisfaction to the operator and patient. The fundamental principles involved in this case are not at all unlike those that I have already described. First, the moulding of the upper arch to its proper shape and size. Then the application of the apparatus and the use of the intermaxillary elastics to bring the lower arch into occlusion with the upper. This, as you will notice, is a developing case, in a boy of eleven. Nine months have elapsed between the two models. During that time the cuspids have erupted and are fast coming into occlusion. One feature regarding this case is that a larger space was left for the eruption of the cuspids than was actually required, in order that they

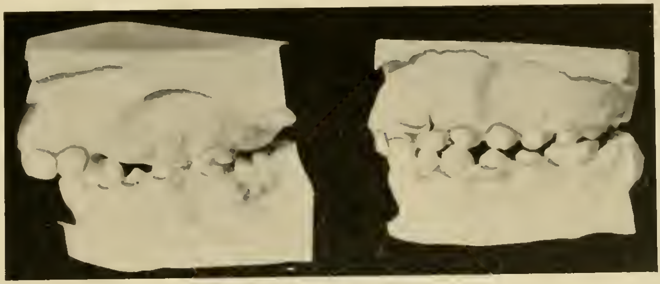

Fig. 8.

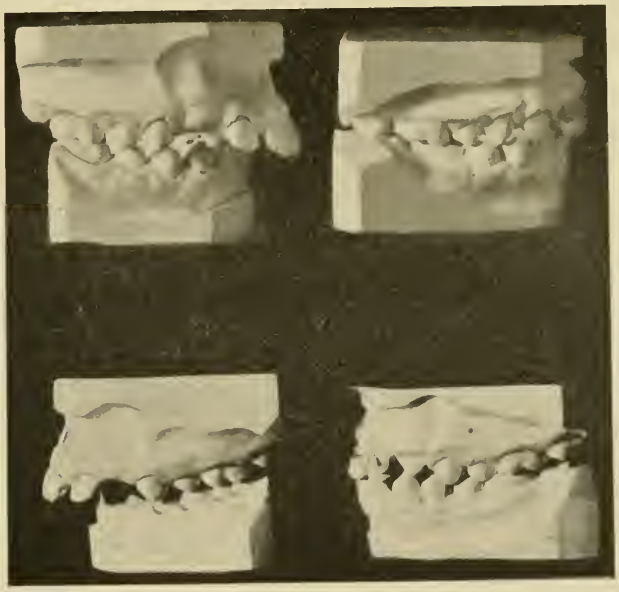

Fig. 9.

might have no interference in the progress of their development. When they have completely erupted, a lingual wire will be cut and intermaxillary elastics applied.

Fig. 10 illustrates a case from beginning to completion. The process of development is discernible without any explanation. The figures illustrate the condition of the bite after the apparatus was applied with the intermediate stages of development. The last figure illustrates the completed case some time after the removal of the appliance.

In order to get all the main points clearly in our minds, it might be well to briefly review: First, the application of the apparatus is intended

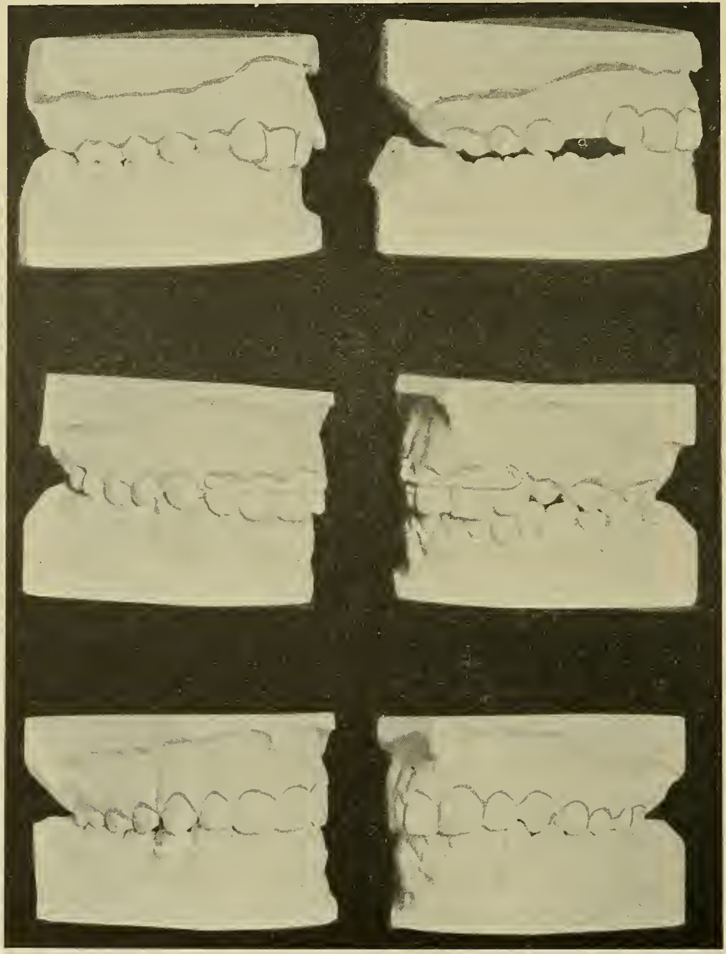

Fig. 10.

primarily for that class of cases where infra-occlusion occurs in the molar and bicuspid region. Second, the appliance is not intended for primary treatment, but follows at a definite stage in the process of treatment which occurs when the first molars and central incisors of the upper arch are in their true relation, and the arch of its proper shape and size. Third, accurate impression and bite must be taken. Fourth, the appliance must be constructed of strong material, carefully soldered, all weak points reinforced. Fifth, after its application, the use of the light intermaxillary elastics to bring the molars into occlusion.

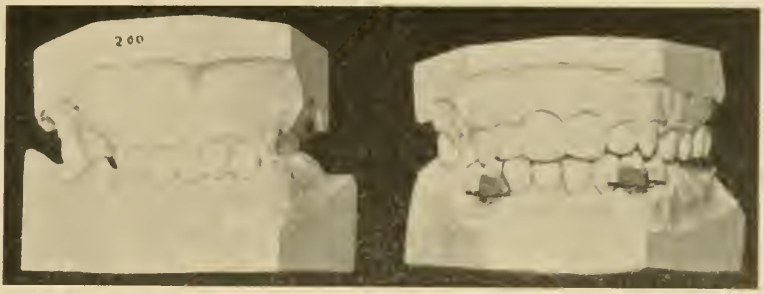

Fig. 11.

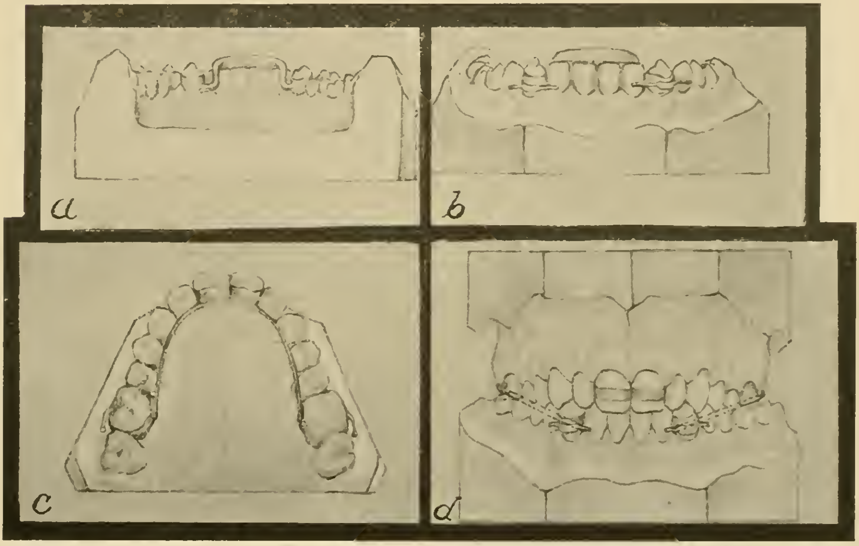

Fig. 12.

The inclined plane may be used *without* the *molar and lingual attachments only in cases where no infra-occlusion exists.*

Inclined Planes in Class III.

One of the most gratifying uses to which I have put the inclined plane is in the treatment and retention of Class 3 cases. In this class of cases I believe there is a field for its extended usefulness.

The following illustrations will show the methods of construction of the inclined plane as applied to the lower arch.

The inclined plane apparatus shown in Fig. II is used principally for retaining purposes, but may, in some cases, be used with profit in the treatment of cases of Class 3, after the teeth of both arches have been placed in alignment. The same kind of material is used in the construction of this apparatus as is used in the construction of the inclined plane for the upper arch. It might be well to call attention to one necessary precaution in the use of the inclined plane for the lower arch,—the upper arch must be held intact by the device shown in the illustration, which represents molar and incisor bands, all four securely soldered to the lingual wire. Buccal hooks should be soldered to the molar bands for the accommodation of intermaxillary elastics, which should be used in the early period of retention. On the lower, a labial wire may be extended from cuspid to cuspid. When this is done, the intermaxillary hooks are placed on the distal side of the cuspid bands.

Discussion of Dr. Rogers's Paper.

Dr. Morehouse. Since I did not get it clear in mind, I would like to ask about the use of the rubber ligatures from the hooks of the upper centrals back to the hooks on the upper first molars.

Dr. Rogers. To elevate and bring the molars into occlusion after they are in correct mesio-distal position, the elastics pass over the buccal hooks of the upper molars and engage the buccal hooks of the lower molars. These elastics must be very light.

Dr. Young. I have used this same principle a good deal in the retention of Class II, and I have found it very satisfactory. There is some little difference, of course, in the detail of the construction of the appliances; that is natural, as no two men work alike, but the general principles are the same. I believe, as was said in the discussion of Dr. Pullen's paper yesterday, that one of the difficult problems in the retention of Class II cases is the correction of the infra-occlusion of the bicuspids and molars. This helps out.

Dr. Ottolengui. I think I have used the inclined plane probably as long as most people, because I was associated with Dr. Kingsley. His inclined plane originally was made of vulcanite, but soon after he began turning over his orthodontia practice to me, I discarded vulcanite, because of an experience in a case like the one last shown, Class II, Div. II, where, as I remember, the infra-occlusion was so great that with the appliance in the mouth it was difficult for the patient to masticate her food. The result was that the mandible was held back in its distal relation in order to eat, and she chewed up the inclined plane! Since then I have never made an inclined plane of vulcanite but I have made a number of roof-plates of iridio-platinum. These carry the plane and are removable, and in persistent cases I still use such appliances at night after the fixed appliance is abandoned.

I have used the inclined plane as a part of a fixed attachment in a number of ways, but meeting with an extreme case of infra-occlusion in the past two years, I treated it successfully in a novel way. I recognized early in the diagnosis the existence of an extreme infra-occlusion. After widening the arches with an appliance attached to the temporary teeth, I noted a coincident loss of all the temporary molars and a coincident eruption of the eight bicuspids. It therefore seemed exceedingly desirable to establish the correct occlusal plane during the eruption of these eight teeth.

For the upper arch I made an appliance consisting of molar bands and a heavy lingual arch wire. To the anterior part of this lingual arch I soldered a flat shelf of clasp metal—not an inclined plane, but simply a flat plane. This slightly opened the bite in the molar region, and the intermaxillary elastics were carried from hooks on a labial arch back over hooks on the molar bands, practically the same as in Dr. Rogers's appliance, Figure 6. The bicuspids continued to erupt and were soon in contact. The upper appliance was then removed and a second layer of clasp metal was soldered immediately over the first. The front edges of this thicker plane were then rounded so that it began to assume the action of an inclined plane, while still operating as a flat plane to open the bite. A month later the molars and bicuspids were again in contact and a third layer was added to the plane and the case dismissed for the summer. When the boy returned in the autumn the molars and bicuspids were found to have erupted fully.

Dr. Rogers. I do not find it necessary to have the inclined plane go back so far, because the intermaxillary elastics are used with it. The patient cannot bite back of it at all. It is also a splendid retainer for the lower incisors, if properly constructed.

Dr. Ottolengui. The apparatus shown by the essayist is efficient in the cases such as those shown, but there are more extreme cases of lack of vertical development. Sometimes there may be a tremendous opening in the molar region in using this principle, and I think in such cases it is an advantage to follow the plan I have outlined.

Dr. Weeks. It is impossible for us to overestimate the necessity of attention to this particular phase, not alone in Class II, but in all cases that come to us for treatment. In the beginning, we should recognize two phases of the question. We should recognize the inequality in the amount of development of the anterior and posterior teeth, and we should recognize the general lack of vertical development. With those two things in mind, we may go on with the consideration of it as it applies to all classes of abnormalities. I am very much indebted to the essayist for his careful consideration of this class of cases. I believe his methods and appliances will be entirely effective; however, I have yet to find in my own experience any case, with perhaps one exception, in which I have been unable to acquire the proper relation between the anterior and posterior teeth in their vertical development, without the use of the intermaxillary force. This is, by giving the posterior teeth an opportunity of further eruption, giving them a period of complete rest of sufficient length to bring about that relation. Again, the necessity of making that treatment a secondary instead of an initiatory phase, seems to me to be open to discussion. For instance, in cases presented to me in the spring of the year, just preceding our summer vacation, it seems to be manifestly worth while to make use of that period of time for the application of an appliance to allow for the vertical development of the posterior portions of the arch. Other than that, I think it would be practical to proceed with the alignment of the arches, and then make this phase a secondary consideration.

Dr. Pullen. During the reading of my paper yesterday, I showed some of Dr. Rogers's slides, his appliances, and the drawings made by myself from his earlier cases, in which it was shown that his inclined planes were larger than he uses now. His idea is to cut down the plane to interfere as little as possible with speech and mastication, and to afford the least lodging place for food. He has perfected the plane considerably since he first showed it to me. I do not think Dr. Rogers explained the use of the double hook on the upper molar clamp band. I will be glad to have him explain its use, and also how far outward the labial hooks extend from the incisor bands. I inferred from the paper that in constructing the apparatus the labial hooks from the incisor bands should extend far enough buccally so that the rubber elastics do not interfere too much with the cuspids or bicuspids.

It is realized that this apparatus is essentially used for developing cases, or growing children, rather than in adult cases, where we find extreme infra-occlusion of molars and bicuspids, with apparent, not real, supra-occlusion of the lower incisors, in which case this appliance will not do the work as well as others. For instance, in a real supra-occlusion of the lower incisors, we must use an apparatus to lift the lower bicuspids, and depress the lower incisors.

Dr. Dunn. It was my fortune to see a well-developed case of the second Division of Class II before, and when practically completed, through Dr. Rogers's treatment. It was an extreme condition of this lack of development vertically in the bicuspid and molar region. I wish to state that the results in that case was very beautiful indeed, and to me it seemed that this method could be used in the more mature cases as well as in the younger ones,—at least in this one instance it worked admirably.

Dr. Morehouse. I would like to ask another question. In passing the ligatures from the hook on the incisors back over the hook on the molars, does it not bring a great deal of pressure on the bicuspid, causing depression, etc.?

Dr. Ketcham. I wish to compliment Dr. Rogers on his paper. It is very good indeed, and his technic is beautiful. I believe that so far as technic goes, if we put a little ferrule on our molar bands and let the end of the lingual arch rest in the ferrule, we can cement the anterior bands in place easily, and if any band loosens there are fewer to remove in order to re-cement in place. The lower retaining wire is best on the lingual side of the teeth. We can often escape banding the lower cuspids by soldering a little spur to the lingual wire, so that it will lie between the lower lateral and cuspid, or against the disto-lingual angle of the lower lateral incisor, as described by Dr. Angle in the seventh edition of "Malocclusion of the Teeth." It keeps the teeth in their proper relations at that point, provided there has been no rotation of any of the anterior teeth.

I have used the inclined plane back of the upper incisors in quite a number of cases with much satisfaction. I have usually soldered it to either the central or lateral incisor bands, and in my own boy's mouth, have had the most unsatisfactory experience of any of the cases I have treated in this way. The case is a Second Division of Class II, Subdivision, with marked over-bite, with molars and bicuspids in infra-occlusion to some extent. After the upper laterals were rotated, heavy bands were placed on them with the lingual inclined plane attached, but his heavy bite drove the laterals up quite a little distance. Then I changed the anchorage to the cuspids, and he is now wearing the appliance attached to those teeth. A little girl just back from a year's trip, having an inclined plane soldered to right upper central and left lateral incisor bands, is doing very nicely.

Dr. Rogers. Regarding the use of the double hook, sometimes you do not need to use the intermaxillary elastics for the correction of the mesio-distal relation. You may then use the buccal molar hooks for the short light elastics to bring the molars together. (Fig. 6.) The length of the labial fingers may be as the case requires. In the last case shown on the screen, the labial fingers were made longer after the cuspids began to erupt. This case was started long before the cuspids came down. Be careful not to allow the elastics to press against the labial surfaces of the cuspids and bicuspids.

Dr. Fischer. Regarding the remark of Dr. Ketcham that he prefers a lingual wire on the lower, would not that interfere with the inclined plane?

Dr. Rogers. The inclined plane does not extend down to the gingival border. It simply needs to engage the upper half or third of the lingual surfaces of the lower incisors.

Dr. Bogue. Do you put that on after you have the forward teeth practically in the position desired?

Dr. Rogers. That is a fundamental principle. Get the arches shaped first and then bring the lower teeth into correct occlusion with it.

Dr. Bogue. You would not undertake to force the development of the grinding teeth?

Dr. Rogers. I would not force development. Use very slight stimulation of the molars in order to procure a good occlusion as soon as possible without discomfort or danger. I have had no difficulty such as Dr. Ottolengui speaks of, as I give instructions that meat be ground, and the child is encouraged to be careful about the mastication of food.

Dr. Young. The inclined plane which Dr. Rogers passed around (Fig. 5), I consider the nicest thing I have seen in the form of an inclined plane. It is much less in the way than anything I have ever used, and I think it a great step forward in the use of the inclined plane in retention.

Dr. Bogue. It seems to me that Dr. Rogers's inclined plane more nearly accomplishes the mathematical curve we want to get, and which is pretty nearly 55-100 radius or a little more. When you get that, if the lower cuspid teeth are correct in their position and far enough apart, occupying the proper position in the arch, you can hold them there by a lingual arch attached to the lower cuspid teeth. I offer my thanks to Dr. Rogers for this appliance.

A Preliminary Study of the Influence of the Forces of Occlusion on the Development of the Bones of the Skull.

By Lawrence W. Baker, D.M.D.
Assistant Professor of Orthodontia, Harvard Dental School.*

Among the first voluntary co-ordinate muscular actions of a human being after coming into the world is that made with the muscles of mastication in taking food to sustain life. Long before the infant can hold up its head, or has gained control over those useful organs, the hands, the muscles of mastication are highly developed and are used with great vigor.

During the act of nursing, the action of this set of muscles is so vigorous that it demands an increased blood supply, to the extent that the heart's action is greatly increased; the excessive flow of blood to these parts is indicated by a reddening of the whole head, and the fontanelles themselves are caused to pulsate so that untrained observers comment on their movement. Later, with the advent of the dental equipment, this group of muscles is given more leverage, and its action becomes consequently more powerful; in fact, the force exerted on the bones of the head from the pull of these muscles during life is tremendous and amounts to many hundreds of thousands of tons of force. I have long been convinced that this great force on the skull, and the great flow of arterial blood to the head caused by this muscular activity, is a powerful influence in the development of the bones of the head and the important organs incased therein. It is the object of this paper to throw some light on this important but generally overlooked subject.

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*From the Research Department of the Harvard University Dental School.

I wish to express thanks for the invaluable aid that Prof. W. B. Cannon has given me during these experiments, and for the use of the Physiological Laboratory of the Harvard Medical School.

As the subject under discussion is so intimately connected with the action of the muscles of mastication, it will be well to consider first a few facts pertaining to the general action of this group of muscles.

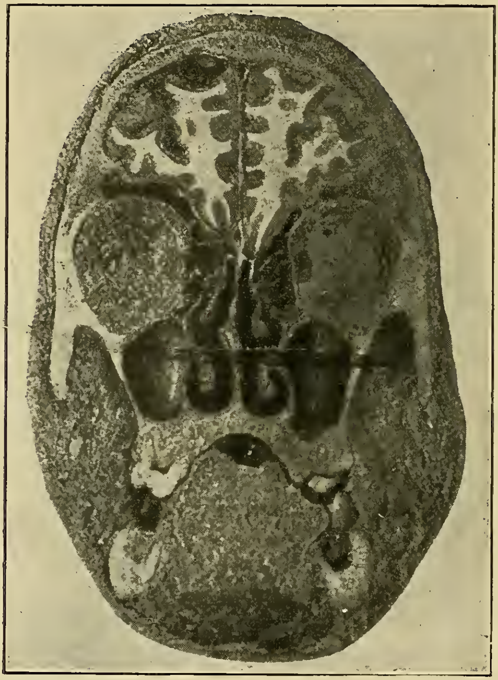

Fig. 1.

Fig. 1. (After Cryer.) Transverse section through the human head in the molar region. Note the size of the massiter muscles and the extent to which they pull on the outer walls of the antrums and on the floors of the orbits.

These muscles to a large extent surround the cranium, extending as they do from the temporal ridge on one side to the temporal ridge on the other side, and the internal muscles of mastication are attached surprisingly close to the base of the brain. All this is shown in illustrations 1, 2 and 3.

It will also be observed from these illustrations that these muscles are attached to the skull, and inserted into the lower jaw, at many different places and in many different ways, so that they pull in as many different directions, but it is a singular fact that, varied as are these muscles in shape, size, power and action, they have one common fulcrum, the dental equipment. The teeth may be truly termed the fulcrum of this group of muscles, because it is only when the teeth are brought together forcibly, or come in contact with food in mastication that the great power of these muscles is brought out. The truth of this statement can be tested by slowly bringing the teeth together. It will be noted that while the lower jaw is swinging freely, the muscular action is almost passive, but the instant the teeth are brought into action, the muscles on the sides of the head and face will be seen to knot out and contract with great vigor, and, of course, the hidden powerful internal muscles do the same.

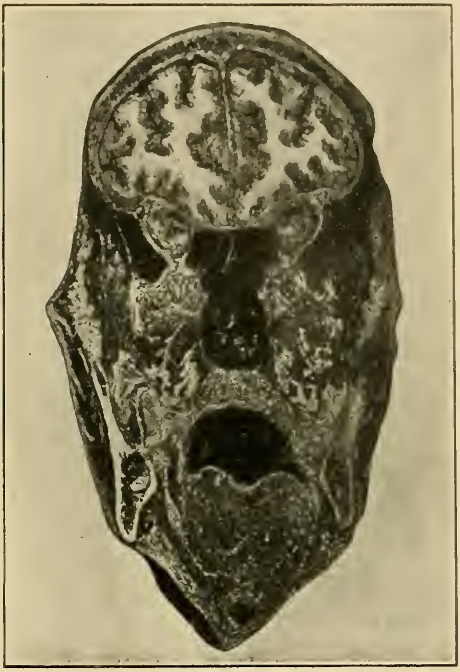

Fig. 2.

Fig. 2. (After Cryer.) Transverse section through the human head in the region of the ascending rami of the lower jaw. Note the extent to which the muscles of mastication pull on the outer walls of the nasal cavities and the close proximity of the attachment of the temporal muscles to the brain.

The resultant forces of these muscles are in reality the forces of occlusion with which members of this society are so notably familiar. You well know that the forces of occlusion are based on definite laws, and it was the early recognition of these laws by you, and your application of these laws to orthodontia, that has placed your society in such an eminent position.

The experiments on which this paper is based, and the experiments which I have at present under way, make me believe that the reaction of these occlusal forces on the skull are based on as definite laws as are the forces of occlusion themselves; furthermore, I believe that in these reactions are locked the secrets of a normal skull; for if a group of forces acts in accordance with laws, why should not the reactions of these forces be governed by just as definite laws as are the forces themselves?

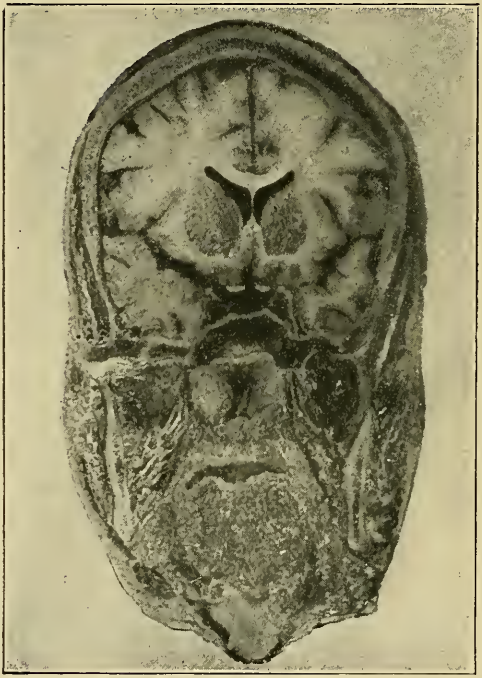

Fig. 3.

Fig. 3. (After Cryer.) Transverse section through the human head further back than in Fig. 2. Note—1st, that the muscles of mastication attach to the base of the brain-case; 2nd, compare the size of this muscular mass to the brain itself; 3rd, note the outward pull on the naso-pharynx of both the external and internal pterygoid muscles.

Before leaving the first three illustrations there are several other matters worthy of consideration; for example, note the area of this muscular mass (including the tongue) as compared with the whole head. It will be observed that it ranks well in size with the other structures or organs of this most compact, intricate and wonderful part of the human body. It is evident to me that nature never would have devoted so much important space to this group of muscles if it were not for the benefit of the head as a whole. According to the laws of evolution, the functional activity of such a mass of muscular tissue cannot but have a direct and powerful influence in shaping the bones to which they are attached.[1]

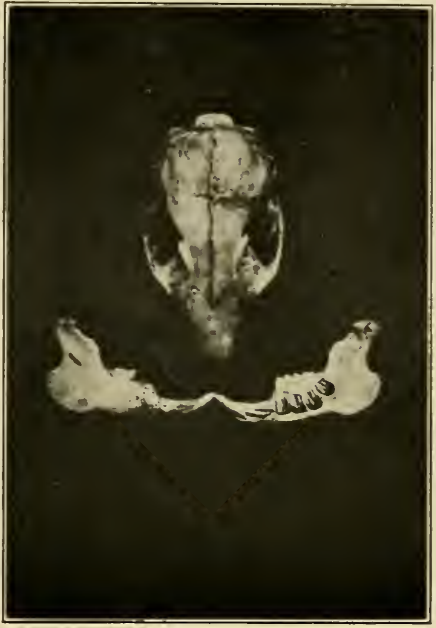

Fig. 4.

Fig. 4. Skull of a young rabbit showing the state of development at the beginning of the experiment.

Furthermore the great supply of pure blood that the vigorous activity of these muscles demands not only rushes to these muscles but also to other parts of the head, and it seems no more than logical to believe that the brain itself shares in this increased blood supply. The idea of muscular activity and increased circulation to the adjacent parts is a well-known fact. Dr. Campbell, in his remarkable series of papers,[2] laid great emphasis on this matter.

It occurred to me that if the hypothesis regarding the influence of the dental equipment on the formation of the bones of the head were correct, interference with the laws of occlusion in the lower animals would show consequent effects in the formation of the bones of the skull; and if variation occurred it might throw some light on the most complex problem of the development of the human head.

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[1] See "Studies of the Internal Anatomy of Face," by Prof. M. H. Cryer.

[2] "Observations on Mastication," London *Lancet*, July 11, 1903, see paragraph, "The influence of the contraction of the masticatory muscles on the local circulation of blood and lymph."

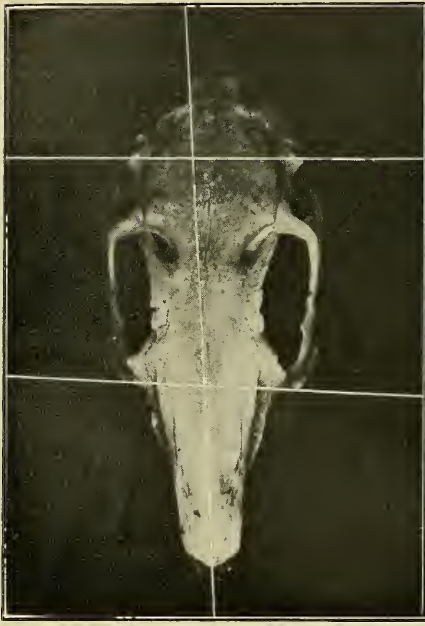

Fig. 5.

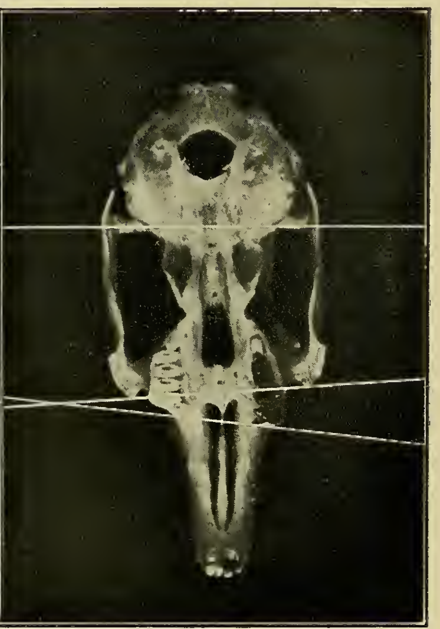

Fig. 6.

Fig. 5. The upper aspect of a skull of an operated-on rabbit. Observe the unequal development of each lateral half of the skull.
Fig. 6. Lower aspect of Fig. 5.

Disuse of Teeth Affects Development.

To test this theory, the following experiment was performed: A litter of four rabbits was selected at the age of weaning. One of the rabbits was chloroformed, and the skull procured is shown in Fig. 4. Two of the remaining animals were operated on by grinding down all the teeth on the right side of the lower jaw and the superior right central incisor. As the teeth elongated, repeated grinding rendered them useless, so that all the mastication was performed on the left side. The fourth rabbit was kept in the normal state for the standard of comparison.

After seven months, the skeleton of one of the rabbits was procured and the skull was found to vary as is shown in Fig. 5, which is a photograph of its upper aspect. It will be noted, by the drawn lines, that there is a deviation of the bones to the left.[3] The suture between the parietal and frontal bones does not run strictly at right angles to the longitudinal axis of the skull; the right frontal bone projects further forward than the left one. It will also be observed that the left zygomatic space is longer than, and more advanced than, the right space. The most noticeable deviation is in the nasal bones, both bones being twisted to the left.

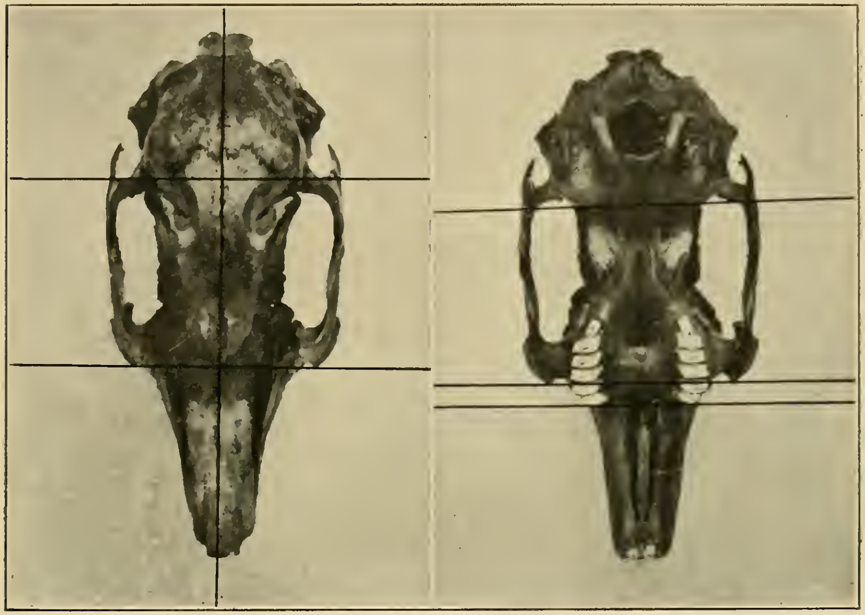

Fig. 7. Fig. 8.

Fig. 7. The upper aspect of the skull of a normal rabbit of the same litter. Observe the normal development of each lateral half of the skull.

Fig. 8. Lower aspect of Fig. 7.

On the lower aspect of the skull, Fig. 6, it will be seen that the deviation extends throughout the entire skull.[4] The most remarkable deviation is that the anterior root of the right zygomatic arch (the zygomatic process of the maxillary bone) is retreated while the body of the right maxillary bone itself with the teeth that it contains is greatly advanced.

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[3] Right and left in this description refers to the right and left side of the animal. (The photographs are reduced in size.)

[4] Contrast figure 5 and 6 with 7 and 8, which are the same views of the skull of the control animal.

Figures 9 and 10 show that the lower jaw, as might be expected, is also distorted, even to the size of the articular processes of the condyles (see Fig. 9). The one on the left, or working side, is perceptibly larger than the right. (Compare with normal lower jaw, Fig. 11.)

Three weeks later, autopsies were performed upon the second altered rabbit and on the "control" animal. In dissecting out the muscles that control the movements of the lower jaw, I was struck with the unequal muscular development of each lateral half of the altered animal. On the unused side the muscles were noticeably atrophied and pale in color as compared with the working side. Later, the skulls were weighed and both the work-on skulls weighed much less than the normal skull, showing that the interference had affected the general osseous development of the head.[5]

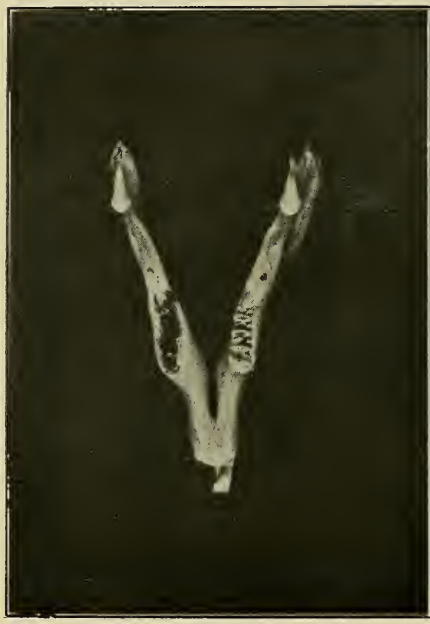

Fig. 9.

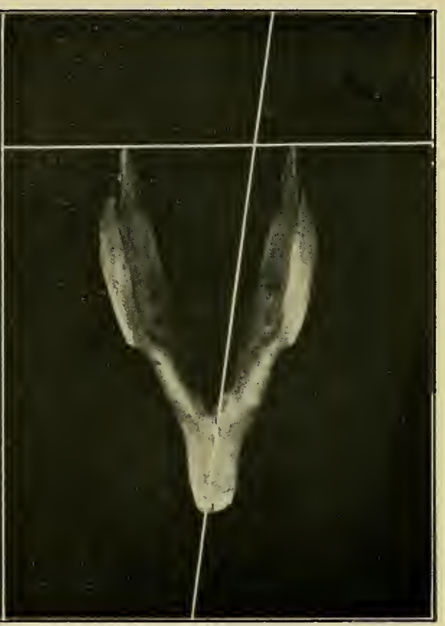

Fig. 10.

Fig. 9. Lower jaw of operated-on rabbit. Note the lack of development of the condyle of the disused side.

Fig. 10. Lower aspect of Fig. 9.

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[5] Weight of animals

Control	1631 grs.
1st operated on	1478 "
2nd " "	1735 "

Weight of skulls

Control animal	248 grs.
1st operated on	227 "
2nd " "	243 "

Figures 12 and 13 show the upper and lower aspects of the skull of the second altered rabbit. It will be noted that it varies in a similar way to the first one, but there is one particular that is worthy of note, and it is that the whole of the superior right aspect of the brain-case was flattened and with it occurred a corresponding lowering of that side of the skull (see Fig. 14).

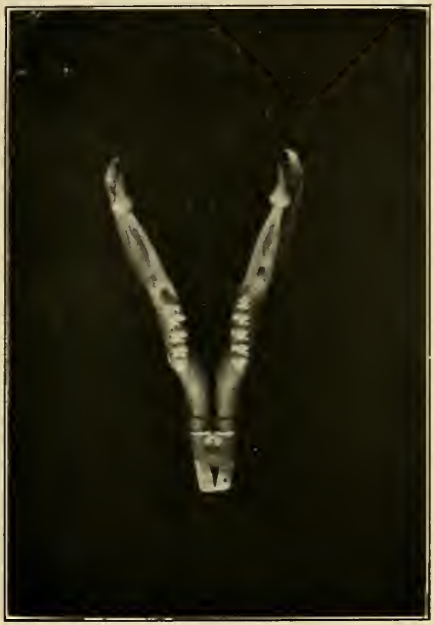

Fig. 11.

Fig. 11. Lower jaw of normal rabbit. Observe its perfect symmetry, and contrast with Fig. 9.

This variation in both cases was not confined to the bones of the head, for the bones of the thorax were also found to be distorted; the sternums were deviated, the ribs were twisted, and there was a spinal curvature in the dorsal region. In preparing the first skeleton, I had not expected to find this distortion except perhaps in the first and second ribs, so this distortion may have been due to the position of the animal during rigor mortis, but in the second animal these distortions were noted within one hour after death, and they did not occur in the normal animal. At present I cannot account for these variations in these thoracic bones, unless it was due to the correlation of growth.

The results of this experiment seem remarkable to me. Who would have thought that by interfering with the laws of occlusion the skulls would have decreased in weight, and that every suture and every bone in the head would have varied as we have seen! This experiment strongly indicates how important is the masticatory equipment of man to the development of the head, and it also brings fresh illustration of the importance of the sadly neglected temporary dentition which serves during the important developmental period of childhood.

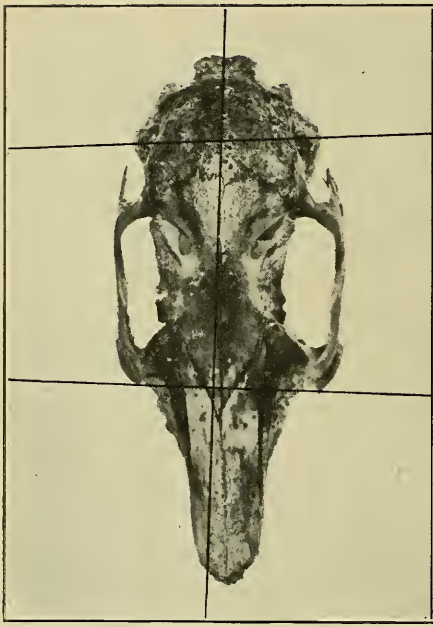

Fig. 12.

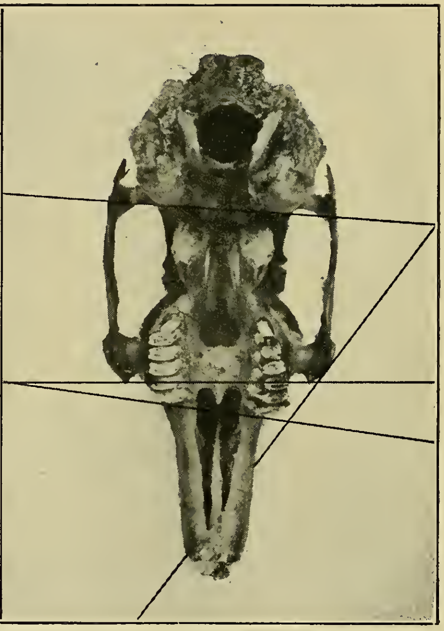

Fig. 13.

Fig. 12. Upper aspect of the skull of another operated-on rabbit of the same litter. Compare with Fig. 5 and contrast with Fig. 7.
Fig. 13. Lower aspect of Fig. 12. Compare with Fig. 6 and contrast with Fig. 8.

Last year I endeavored to repeat these experiments and to continue the work on other classes of animals, but unfortunately my animals were attacked by a distemper, which so seriously interfered with my work that during the entire year I was able to make but one new observation worthy of note here.

Observations of Carnivorous Animals.

I found in working on carnivorous animals (cats) that the disuse of the muscles of mastication on one side materially interfered with the ossification of the bones of the skull on that side. As this seems to me a very important observation, I will state how I happened to note it.

I noticed in examining freshly prepared skulls of the animals operated on, that when the sides of the brain-case were pressed between the thumb and finger, the bone on the side where the function of the teeth was interfered with was so soft that it could readily be dented in, while the bone on the normal side was dense and unyielding. In the control animals, each side of the brain-case was found to be equally well developed and, in fact, it was impossible for this finger pressure to cause any denting of the bones.

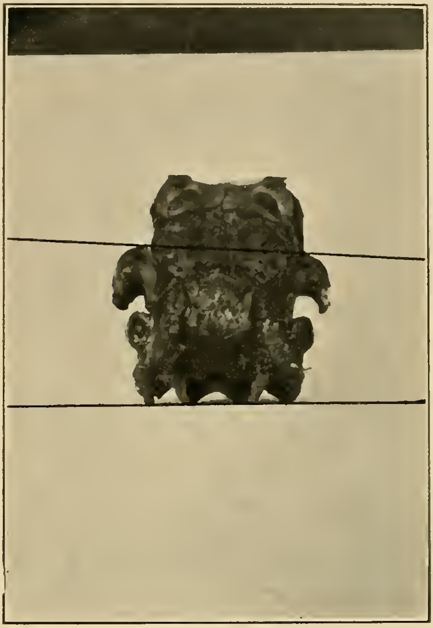

Fig. 14.

Fig. 14. Posterior aspect of the skull of an operated-on rabbit. Note the unequal development of each lateral half of the brain-case.

This photograph shows clearly the far-reaching influence of the use of the teeth in the development of the bones of the skull, for the most remote bones from the teeth have been perceptibly varied by interfering with their function.

The statement that the shape of the skull in the lower animals can be modified, and the strength of the sides of the brain-case can be varied, by simply interfering with the function of the teeth, seems almost incredible. The truth of this statement can be better understood when we study further into the great power of the masticatory muscular system.

In the human being, the force required to thoroughly masticate a lean corned-beef sandwich was estimated to amount to about three tons. Who would believe that 7,050 pounds of pressure were exerted on the bones of the skull through the medium of the teeth in masticating this simple article of food!

These figures were derived from the following test: A man with 32 teeth, in good condition, was selected for the test subject. The test food consisted of an ordinary lean corned-beef sandwich, 2½ inches by 3½ inches. This was masticated until it was involuntarily swallowed. The number of mouthfuls, and the number of chews per mouthful, and the time consumed, were all carefully noted. The force with which the teeth were brought together was estimated to be 10 pounds for each contraction of the muscles of mastication, which is a very conservative estimate.[6] The time consumed in leisurely eating the test food was about nine minutes, and, as has been stated, the estimated force was 7,050 pounds. A second person in making a similar test required 52 contractions less than the former, but the meat was much more tender than in the first case.

If these deductions are at all accurate, the force exerted on the skull through the medium of the teeth over a period of time can be easily calculated, and will be found to be enormous. Thus we readily see how interfering with one side of the dental equipment in an animal can affect the shape and structure of the skull, for according to the laws of evolution, we know that the continuous muscular force exerted on a given bone determines the shape of that bone.

The argument might be raised that the conditions in man and in the lower animals are not at all alike, and no true analogy can be drawn. It is very true that the dentition in man and in the lower animals differs, and it is also true that the dentition in the various classes of animals differs one from another, but in both man and in the lower animals the muscles which control the motion of the lower jaw correspond so closely that every muscle and every bony process is strikingly similar, even to

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[6] The amount of force required to crush food has been very carefully studied by two investigators, Dr. G. V. Black and Dr. Joseph Head. Dr. Black confines his work to the *direct* force required to crush food (see *Dental Cosmos*, 1895, Vol. XXXVII, pp. 478-484), while Dr. Head directed his investigation towards the *trituration* of food (see *Dental Cosmos*, 1906, Vol. XLVIII, pp. 1189-1192). Both of these experiments were more to determine the crushing point of food than the amount of force required to masticate food; so to estimate the force required to masticate a given article of food the number of closures of the jaws must be considered.

The following table shows the comparative results of these two investigations in crushing meat. It will be noted that the trituration gives a lower crushing force, with one exception, than the direct pressure:

	Dr. Head lbs.	Dr. Black lbs.
Corned beef	18-22	30-35
Tenderloin of beefsteak, very tender	8-9	35-40
Round of beefsteak, tough	38-42	60-80
Roast beef	20-35	35-50
Boiled ham	10-14	40-60
Pork chops	25-30	20-25
Roast veal	16	35-40

the hamular processes of the sphenoid bone. So if interfering with the laws of occlusion in the lower animals will cause every bone in the skull to vary and cause a decrease in the weight of this bony structure, and even cause a change in the strength of the brain-case, these experiments will certainly shed new light on the importance of the human dental equipment.

In conclusion, I wish to make it clear that this is but a preliminary consideration of this subject, and I venture to bring my findings before you simply because they so strongly indicate the far-reaching importance of orthodontic work. Later, I hope to present for your consideration future work along this line of investigation. Finally, I wish to add that the writings of E. A. Bogue have been an important factor in influencing me to undertake this line of experimentation.

Discussion of Dr. Baker's Paper.

Dr. G. M. Wright. My paper to-morrow will deal with the effect of such deformities as Dr. Baker's investigation would prove occur in malformed sinuses and malformed brain cavities, and it is so nearly in the line of Dr. Baker's paper that I am afraid I will lose my thunder by talking on the subject this afternoon instead of waiting until to-morrow morning. This paper has been very interesting to me, and is a true addition to our knowledge of the development of these parts. As to whether the muscles of the outside of the face, which are so powerful and so much used, have to do with the development of the sinuses, particularly those accessory to the nose, that would present itself to me, from Dr. Baker's reasoning, as a debatable point. On the slides shown it looked to me as though perhaps the influence of nasal respiration, the air pressure, etc., would have as much to do in crowding out those spaces as the muscles on the outside have in contracting and bringing them in. Referring to the last slide by Dr. Cryer, the septum deviates markedly toward the left, and the ethmoidal cells on the left are large as compared to those on the right. The frontal sinuses are usually unequally developed, and in this case they are greater on the right than on the left. In an examination of perhaps three hundred and seventy-five normal individuals of the Caucasian race, two hundred and forty had deflected septums. Some say this is due to the height of the arch, and I think that may be true. The eminent anatomist, Cunningham, says his researches prove that all of the frontal sinuses have been developed larger in the adult on the side from which the septum has been turned. This last illustration of Dr. Baker's is one of the most beautiful one could have. It would be interesting if we could note the effect on brain development. The cranial capacity has been probably interfered with, and I wonder if Dr. Baker made any comparative measurements of a rabbit at that same age, as that of the rabbit that was not normal.

Dr. Baker. I did not make a measurement in the sense of a measurement, but I did in weight. I filled those skulls with fine bird shot, and then I poured the shot out and weighed the skull contents. One of the rabbits operated on showed a brain capacity much less than the control animal; and in the other the weight was the same, but there is a question of sex that enters in here, and I do not dare to make a definite deduction. I want to prove that interfering with the occlusion in this way does cause a variation in the development of the brain capacity. This is a preliminary experiment only.

Dr. Wright. A study of craniology shows a great difference in the capacity of different skulls, particularly those of the Aborigines. The Icelander has a skull of about the same capacity as our own, although he is not of an educated race. In the Aborigines we find but few deviated septums. When we do find them they are usually the result of traumatism. In one hundred skulls of Indians in Wisconsin, which were in my possession at one time, I found no instance of a deviated septum, nor of a high dental arch, except such as came from traumatism. In specimens I have noted in London, Berlin and Vienna, it is shown that the Aboriginal races are not heir to such malformations, malocclusions, deviated septums, etc., as is the Caucasian race. In working two years ago last winter with Hurst, the first assistant of Dr. Hyatt, we wished to get an answer from different men of large experience as to this matter. We wrote to eminent rhinologists, etc., asking, "Do you find that the negro, after one or two generations of habitation in the unhygienic surroundings of your city, has developed the same number of malformed septums and high dental arches as the white child?" and invariably the answer came that they did not. The negro, with near relation to the Aborigines, has not been grinding and cooking his food too well, and saving himself too much labor in the preparation of his food as we have; he has not slept in the overheated bed chambers, and subjugated the nasal mucous membrane to a variation of 80 or 90 degrees as he goes out in the morning, and he has developed his breathing capacity by doing his errands on his own legs instead of using the street-car, and consequently he does not have need for the orthodontist as the whites have.

Dr. E. A. Bogue. It seems to me that all the way along we have been putting our cart before the horse. Don't you think, Dr. Wright, that the pictures which Dr. Cryer exhibits of malformed, or misplaced, antra, show a failure in the performance of function on the side where the diminution exists? And then don't you think that in the light of recent developments, the "Baker developments," if you please, that where we noted phenomena that we have all seen in the faces of our patients, and noted on our records, not knowing just what to attribute them to, may we not hereafter attribute them with much more accuracy to the failure of the performance of function further back, in the process of development?

Referring again to Dr. Baker's rabbits, showing the tempero-maxillary articulation on the right side, there is no doubt that they failed to develop on that side. In those specimens, the failure of development is marked: it is not a fancy, and lest it be looked on as a fancy Dr. Baker has drawn mathematical lines, and you cannot question them.

There has been a great deal written on these subjects, but most of it has not been demonstrated: we cannot reach any point where we can say we have proven anything, but there is a lot of accumulated evidence, going to show that Dr. Wright was correct five minutes ago when speaking of the negro and malformed septa. It has been pretty well demonstrated that the development of bone is promoted by the exercise of the function of the muscles attached to those bones. When the Scotch fisherman at eighty has good teeth, and his daughter wears artificial ones, there is a reason; and when the same thing is true in Sweden and Norway and partially true in other countries, we begin to think of the reason again, and whenever I try to follow the matter up at all (and Dr. Baker has spurred me on), I find that invariably where these people have lost their teeth comparatively early in life, they have failed in childhood to masticate hard food. A gentleman with whom I crossed the water a few years ago, Dr. Shannon of Seattle, was one of eight children, who from the mother's breast were immediately set at the table and allowed to take crusts, and bite on large pieces of meat, and gnaw chop bones, and he said that not one of the eight had any difficulty with the eustachian tubes, the eyes, nose or dental arches, and that for twenty years not one of his family had ever required the services of the dentist, and he himself not until thirty, and then to lance the gum over a wisdom tooth. He said the same thing was probably true of all those of whom he had any knowledge in the village where he lived. All of this is cumulative evidence.

Dr. Grenfel, the Labrador Medical Missionary, told me personally that something more than fifty per cent. of his Labradorians are now affected with adenoids, which perhaps is a step in advance in the knowledge of that locality.

Dr. Wright. At the State Capitol we have between sixty and seventy skulls of cliff dwellers, and you gentlemen might find them interesting to study and note the development of the dental arches of those who are probably as nearly Aborigines as any specimens we have in America. They may be seen in the basement of the Capitol at any time you go up there. The keeper in charge will give you full right to look them over.

Dr. W. J. Brady. Mr. President and Gentlemen: I realize, as you must do, that when we begin to discuss subjects of this kind we are getting into pretty deep water. However, if we all hesitated to go in deep water, none of us would ever learn to swim. Everything we are able to add to the general stock of knowledge counts for something, though it may be about something on which our knowledge will never be complete.

We realize that no one man can compass all we may wish to know of a subject, hence the value of two discussions pertaining to the same thing. I have been much interested in the pictures and remarks of Dr. Baker, and the excellent and scholarly paper of Dr. Wright, not only because of the intrinsic value of each, but also because they are along the line of certain investigations I have made myself—very limited compared to what I wish they were—and all bearing upon the same question, *i.e.,* what controls or influences the growth of the bones of the face and skull.

We know these bones do not always grow alike; there can be no question on that point. We have all seen and wondered over wide departures from the usual form. In searching for the causes of these variations, there are many different things to consider. It is with considerable pride that I note we have got away from many of the old ideas prevailing about deformities of bones of the face; from the old belief of heredity of such things; from the old supposition that sucking the thumb is the cause of so much malocclusion, and many other things equally unproven by observation and reasoning.

It is the belief of some that adenoids are responsible for almost everything in the way of non-development of the face, but adenoids alone is not a satisfactory explanation. We must go deeper than that; to understand development and non-development, we must consider the normal performance of function—the normal use to which a part or organ is put. The exhibition by Dr. Baker shows the effects of normal use most decidedly. If we study deeply into bad malformations connected with adenoids, we will find that the adenoid enlargement proper is only one of the contributing causes to the general condition. The use which nature intended, producing the stimulation necessary for growth, has not been given.

It is intended by nature that air shall be taken freely through the nasal opening, and that this air should be warmed and moistened thereby. This calls for a constant blood and lymph supply to the lining of the upper respiratory tract, and then follows a constant reaction upon those tissues by their performance of this their natural function. The presence of adenoids interferes with nasal respiration, and the function of numerous tissues is but scantily performed—again disuse, with consequent lack of development.

Nasal respiration normally produces ventilation of all the connected sinuses, and lack of this ventilation has a considerable effect upon development, especially as the only function of these various cells and sinuses is to contain air, so far as we know. When the air contents are not normally swirling in and out with every breath, they fail to develop, just as the lungs fail to grow when not given full use.

The bones of the skull develop after laws of their own. The brain development and skull development always coincide. So far as we know, no outside influences affect the skull development, unless its growth is accidentally or intentionally changed, as, for instance, the compression between boards by certain tribes of Indians for purposes of beauty—that is, beauty according to their standards. But the bones of the face are different. They are simply plastered on the skull, and use or disuse is one of the most potent factors in developing them.

Of course, our friend Talbot does not agree with this, and explains every lack of development from the standpoint of degeneracy. Whether there is anything in the brain and nervous system that dominates the development of the bones of the face is entirely beyond me to say. I have asked many neurologists that question, and they have all avoided a direct reply. When connected with the State University of Iowa I inquired of several biologists as to the exact control the nervous system exercises over the development of the various organs, and to my surprise they told me it has little or no influence until the body of any animal is well formed; that the nervous system is very incompletely developed until the body and organs are well modeled, and that it is a very debatable question whether the nervous system ever governs development beyond influencing tissue nutrition through the trophic fibers. That rather demolishes the theory that abnormal brain development controls, or is responsible for, unusual or abnormal bones of the face.

I am sorry I cannot discuss a matter of this importance more intelligently. Some time I hope to bring something along this same line before this Society, and show the growth of the face by a series of moving pictures. Possibly I am too ambitious in aspiring to this, but I shall never be really happy until the growth of the face is actually shown on the screen before us.

Dr. Federspiel. Dr. Brady suggested that the brain may have something to do with the development of the jaws, face, and skull. I wish to add that if we had a scientific knowledge of the glands and their functions it would be beneficial. We know that the glands play an important part in the development of the body, physically and mentally.

Dr. Baker. I would like to ask the last speaker if he has read the work of Geo. H. Wright, of Boston, on the Tonsil and Its Relation to the Teeth? It is a very fine article.

Dr. Bogue's work has been one of the factors stimulating me to undertake this investigation. He told us all things ten or twelve years ago that we did not believe at the time. I did not believe that normal occlusion was necessary to the normal development of the skull: I said Dr. Bogue was a "faddist!" He is right. You must have normal occlusion to have the normal muscular pull, and you must have the fulcrum normal. Of course, you must realize from what I have said that I am a great believer in Darwin's work. I am just beginning this study. There are many problems to solve, and when I get to be sixty or seventy years old, if I work until then, I may say something more definite than to-day.

Mal-Formed Bones of the Face As a Cause of Brain Inactivity.

By G. M. Wright, M.D., Denver, Colo.

In this consideration of brain inactivity, it will be my purpose to study the changes taking place within the cranium, which are a direct cause of aprosexia, and to show *why* and *how* malformations, which interfere with the normal performance of the physiological functions of the accessory sinuses of the nose, together with an interference with the lymphatic circulation within the nasal fossæ, are directly responsible for such intercranial conditions.

We have believed up to the last few years that the mental lethargy attendant upon nasal obstruction is due to the want of oxygen in the blood. This explanation, which I believe to be erroneous, we have accepted because of a lack of knowledge, both as to anatomical construction and physiological functions of the nose and accessory sinuses.

A true explanation of the mental condition following nasal obstruction, I believe, will be found in the interference with two important physiological functions; namely, the lymphatic and venous circulation of the nose and accessory sinuses, so intimately connected with that of the base of the brain.

Physiologists agree that a moderate pressure on the brain, *i. e.*, not enough to cause vertigo, loss of consciousness, etc., may produce disturbances of the nutrition of the brain with consecutive phenomena, such as slight headaches, feeling of dullness, muscular weakness, etc., so that if we can prove that such malformations as deflected septums, enlarged turbinates, high dental arches that allow the roof of the mouth to usurp territory which should belong to the nasal fossæ, retard the lymphatic and venous circulation within the nose and sinuses, and that this circulation is so intimately connected with that of the base of the brain that it, *per se,* must also be affected and cause pressure, we will, in a great measure, have explained the reason for brain inactivity in these cases. To this end, let us study the anatomy of these parts and their relation to cerebral circulation.

Anatomy of Sinuses.

Anatomists have known for hundreds of years of the existence of the pneumatic spaces. It is interesting to review the works of the early anatomists: Tallopius, 1542; Bartholini, 1655; Willis, 1664; Eustachius, 1717; Vasalius, 1725; Winslow, 1732; Morganii, 1779; Bechat, 1819, and Cruveilhier, whom Gray quotes so extensively, and note the descriptions given of, and reasons advanced for the existence of these pneumatic spaces. (Here I wish to take occasion to thank Dr. S. W. Hartt, of this city, for his kindness in allowing me access to his anatomical library, which I believe to be one of the most complete in America.)

Later anatomists seem to have been content to accept the belief that the pneumatic spaces are of but little importance, and follow the description of those who had gone before, so that it was during the last century that we got our first accurate description of all these spaces, and their communication with the nose.

In as estimable a work as Daniel Eisendrath's *Clinical Anatomy,* edition of 1903, page 93, we read under "Internal Nose": "It has openings in its lateral walls into the pneumatic cavities, or accessory sinuses, situated in the bones of the face and skull. The exact function of these accessory sinuses is not clear. In their development, they probably aid through giving the facial bones an opportunity to grow without increasing their bulk." This seems to have been the most prevalent excuse given for nature having created these spaces.

Ambrose Paré, in his work on surgery, states that penetrating wounds of the forehead in which bubbles of air come through when the patient holds his nose and blows, stand a much better chance of recovery than others.

Sinus Respiration.

It seems as though physiologists should have given more thought to sinus respiration than they have, when we take into consideration the numerous instances of foreign substances which have been breathed up into the frontal sinus, thereby calling attention to the fact that air was drawn up in the sinus.

Foreign bodies enter the frontal sinus through the natural channel. (*Reference Hand-book of the Medical Sciences,* Vol. 3, page 260.) A notable instance is recorded by Gross of a child who lost its life from irritation caused by the development in the frontal sinus of an immense number of spiders, the parent of which had been inhaled while the child was smelling a flower. The ova of insects are inhaled directly into the sinuses from fruit and flowers, upon which they have been deposited. This is said to occur particularly in India, and the disease thus set up is called "Peenash." Such instances should prove that there is a sinus respiration, and investigation will show that it has an important physiological function.

Anatomists claim that the majority of adults have deviated septums. Zuckenkandl found 240 in examining 370 people, and McClellan, in his *Regional Anatomy,* edition 1901, says of the frontal sinus: "They are usually unsymmetrical, the larger being on the side from which the nasal septum is bent," which I would construe as proof that it is necessary that the formation be such as to make it possible for a free column of air, not unduly obstructed, to enter the sinus, in order to allow them to make a normal development.

Venous System of the Sinuses.

Before going into the physiology of sinus respiration, that we may be in a position to more clearly appreciate the importance of its relation to the venous circulation of the brain, let us review the anatomy of the emissary veins connecting these sinuses and the posterior pharynx with the basilar venous circulation. Anatomists not long ago were quite united in claiming that the *foramen caecum* closed at birth. The *Reference Hand-book of the Medical Sciences,* Vol. 3, page 243, says: "The *foramen caecum* in foetal life furnishes a communication between the longitudinal sinus and the veins of the frontal sinus, ethmoidal bone and nose, rarely, if ever, observed in the adult;" while McClellan's edition of 1901 says: "A connection exists more often than is supposed between the veins of the nasal fossæ and the front part of the longitudinal sinus through the *foramen caecum,* which in such cases is not closed." Again, on page 115, he says: "In children, there is almost always a communication between the nasal veins and the superior longitudinal sinus through the *foramen caecum.* This is usually closed about puberty, but may continue in the adult."

Cunningham's anatomy, edition 1906, says: "The superior longitudinal sinus commences in the anterior fossæ of the cranium at the *crista galli,* where it communicates through the *foramen caecum* with the veins of the nasal cavity, or with the angular veins." Again, of the emissary veins, Cunningham says: "The cavernous sinus communicated with the pterygoid plexus in the zygomatic fossæ by an emissary vein, which passes either through the *foramen ovale* or through the *foramen vesalii.*"

Morris's Anatomy, edition of 1907, says: "The cranial blood sinuses are continuous on the one hand, with the meningeal veins, and on the other hand, with the veins outside the cranial wall. The vessels which establish communication between the blood and sinuses and the extra cranial veins, are referred to collectively as emissary veins. They possibly help maintain the regularity of the cranial circulation, and they have, therefore, a certain amount of practical importance."

This is the first instance I have found of an anatomist calling attention to the importance of the emissary veins, because of their influence on cranial circulation. We have, then, supplying these parts, an emissary vein passing from the superior sagittal sinus through the *foramen caecum,* and communicating with the veins of the roof of the nose, or through the nasal bones with the angular veins; other emissary veins pass from the pharyngeal plexus, supplying the posterior pharynx through the *foramen ovale* or the *foramen vesalii* to the cavernous plexus, and the anterior and posterior ethmoidal veins have direct communication with the veins at the base of the brain through the cavernous plexus.

Influence of Sinus Respiration.

Let us see, then, the influence of sinus respiration on these thin walled extra- and intra-cranial veins. We know that the column of air which, during apnea, is under the same pressure as that of the atmosphere, has a negative pressure when forced from the trachea upward, and makes room for external air to rush in and take its place.

This change of air pressure must affect the air within the accessory sinuses, and in these, as well as the nose, a change of pressure is observed during expiration. It is at this moment that the sinuses assume a physiological importance.

During inspiration, the air is drawn out of the sinuses and a negative pressure (less the atmospheric) is produced, therefore emptying the ethmoidal and other emissary veins, at every inspiration, through this pump action of the pressure and release of pressure on these veins, and through them the longitudinal sinus and cavernous plexus. When the nose becomes so obstructed by malformations that air does not pass through it, this mechanism is interfered with, and venous hyperemia of the meninges is produced, forming an important factor in the aprosexia of these cases.

Lymphatics.

Leaving the venous circulation and considering the lymphatic, the same causes that produce the venous stasis will produce lymphatic stagnation. It has been recently shown by Ceuno and Andri that the peri-meningeal spaces communicate with the lymphatics of the nasal fossæ across the cribriform plate of the ethmoid by canals, which are independent of those for the sheaths of the olfactory nerve.

This intimate relation between the lymphatics of the nose and base of the brain we now believe explains the meningitis met with in scarlet fever and congenital syphilis, as well as tubercular meningitis from direct infection. Strauss has found Koch's bacillus in the nasal cavities of children dying from tubercular meningitis.

Tilly says that, "direct communication between the lymphatics of the olfactory region and the basal lymphatics of the *dura mater* has been demonstrated beyond a doubt." So it is certainly not an unreasonable theory, that the interference with the lymphatic circulation in the nasal fossæ, so closely connected with that of the base of the brain, plays a very important part in the stagnation of the meningeal lymph circulation, and, consequent brain inactivity.

Grunwall says: "This vacant stare found in these cases corresponds perfectly with the psychic abnormality, and is due in the brain to stagnation of lymph at the base of the skull, which always accompanies nasal obstruction." This lymphatic stagnation, then, we must admit, plays an important part in this sequella of nasal obstruction, and as we gain a more thorough understanding of the physiological relation of the venous and lymphatic circulation of the nose and accessory sinuses and their relation to that of the brain, I believe we will get to more thoroughly understand the pathologic phenomena producing the marked mental lethargy in these cases.

Discussion of Dr. Wright's Paper.

Dr. Bogue. Mr. President and Gentlemen: I looked for all the little defects I could find in this paper on the train, and was strongly reminded of two priests in Sunday-school, one of whom asked his little pupil if she knew about the sacrament of matrimony. She thought she did. He asked her to describe it. She said it was "a condition in which souls suffer for a time to prepare them for a better state." One priest said, "Do not say that." The other priest said, "Let her alone, brother, she may be right for all you and I know." I do not feel willing to take issue with Dr. Wright in his assumption of brain inactivity in the first part of his paper, because, as the priest says, "He may be right for all you and I know," but I want to learn if he intended to include the palate bones among the bones of the face, for he speaks of the changes taking place in the bones of the cranium. If he includes the bones of the palate, I should question the correctness of his assumption. A cleft palate patient I had a few years ago was sufficiently active in brain to found two newspapers in New York City, one of which *The Mail,* still survives.

Two or three minutes ago Dr. Wright brought up this sentence, "All large frontal sinuses being on the side from which the nasal septum is bent." There is another instance where, as stated yesterday, the cart is before the horse. The frontal sinuses to which Dr. Cryer is constantly calling attention varies in size, to be sure, and the fact exists that the larger frontal sinus is on the side from which the nasal septum is bent, but how did it become bent? That is the point, and Dr. Wright has hit that point. It is from disuse, as Dr. Baker has been trying to learn along a little different line.

The knowledge we have on this subject of brain inactivity is necessarily limited, and nearly all empirical, but we have a large number of contributory facts going to show the correctness of the reasoning that connects defective bones of the face and head with brain inactivity or brain perversion. The most recent investigation shows the growth of bone largely dependent on the functional activity of the muscles having their insertion in the bones. I allude to Dr. Baker's experiments on the two rabbits, and quote it: His two rabbits had the teeth from one side ground down so that mastication on that side was impossible: function on that side was not fulfilled. These conditions were maintained seven months, and then the whole litter was killed, and the skulls cleaned for examination. The two mutilated ones were found to have the mandible much smaller on the mutilated side, causing deflection to that side. These deflections were shared by the upper maxillary and nasal passages as well, which were both smaller on the mutilated side than on the other, causing necessarily from that smallness curvature of the nasal septum: a mechanical matter. This diminution of size continued right on up to the skull, the mesial suture of which was deflected toward the right side, and the whole brain cavity on that side was visibly smaller than on the other side. The weight of these two skulls was less than that of the other skulls belonging to the same litter, which proves the necessity of the performance of function during the period of growth, and the inevitable deformity resulting when this function is interfered with or suspended. Dr. Baker also reports that this variation was not confined entirely to the bones of the head, "but the bones of the thorax were distorted: the bones of the sternum deviated, ribs twisted, and there was a spinal curvature in the dorsal region."

"This experiment strongly indicated how important is the masticatory equipment of man to the development of the head, and it also brings fresh illustration of the importance of the sadly neglected temporary dentition, which serves during the important developmental period of childhood."

In advocating "pap," Dr. Holt, it seems to me, with all due respect to him, has done a tremendous injury to the rising generation. I will draw attention to a case not far away from Dr. Wright's subject. A girl of four years, the daughter of a surgeon, was brought to me straight from Dr. Holt's office. The child had pyorrhea about her temporary teeth to an extent which I have never seen equalled before or since. The gums bled at the slightest touch, and the child could not chew; the whole condition was lamentable. Plenty of pus was present.

Dr. Fisher. I would like a little more of the history of that case, if the chair will allow.

Dr. Bogue. I will speak of it as fully as I may be allowed. I said to the mother, "I will treat that little girl, but I want you to put her on the track of masticating her food." "But she cannot," the mother replied. "But she must. Then give her the bones and let her pick the meat off the bones with her teeth." "Horrible!" "Well, you may say 'horrible' if you like, but that is what I want you to do, and I want you to give her gum to chew." "That is still more horrible." "Never mind, please do what I want you to do. The child is only four years of age and is not in society." I cleansed the teeth from tartar, applied iodine (an aqueous solution) and sulphate of zinc a good deal stronger than Dr. Ferris will advise; I then put little brushes in my engine and scrubbed the teeth with pumice stone, and allowed the pressure to come against the gums pretty liberally. The child did not complain. The child began her chops and her gum. I saw her two weeks ago, and a more perfect set of teeth in position, and a more perfect set of gums, I do not want to see.

Dr. Ottolengui. How old is she now?

Dr. Bogue. Thirteen or fourteen now. The child has been made to masticate from that day to this.

Dr. Fisher. When did the pyorrhea disappear?

Dr. Bogue. After four or five days.

Dr. Fisher. All discharge gone in four or five days?

Dr. Bogue. Don't you see I removed the cause of the pus, cleansed away the tartar, shrunk the gums down, and by the brushing the child lost all her fear of the work, and from the moment the teeth were clean and gums shrunk down, they stayed there.

Dr. Fisher. Was the alveolus involved?

Dr. Bogue. It was not.

Dr. Fisher. It could not be pyorrhea unless the alveolus was involved.

Dr. Bogue. Pardon me. All of us have to learn a little something. The name "pyorrhea alveolaris" is Latin, and simply means flow of pus from the alveolus, just as gonorrhoea means another flow of pus.

If there is malformation of any of the bones of the face, that is in itself fair evidence that the function of that part is not being properly performed. If any bone is malformed enough to attract the attention of its possessor, he fails to pay undivided attention to the things around him, and so is less active than those around him. The malformation may be of the nose, or of the eustachian tube, or of the dental arches, and in all cases where the deformity is great enough to cause physical discomfort, the result is that the attention of the individual is more or less distracted, and his normal development interfered with.

Rev. Dr. Travis, Ph.D., has spent several years investigating criminals and insane, and studying the works of Lombroso and Ferri, the famous Italian criminologists, and his conclusions are summed up as follows: "1. Any defect which occurs to the breathing organs of a child would tend to delay development. 2. If acute, and in the nose, it would tend to develop mouth breathing, with its bad results on mind and body. 3. If this defect occurred at the critical age, with regard to speech imitation, etc., it would delay these, and therefore make the child backward. 4. If later, at first school age, it would handicap learning, and perhaps make study irksome, and tend to make natural exercise, as running, etc., irksome, and therefore might have serious results, not only on mental and physical development, but also on moral, by making the boy appear dull, thereby losing the respect of bright children, and falling below his grade. It would tend to truancy, and this is one of the broad roads to criminality. A sluggish and poorly developed body tends to bar him from games, and therefore from the respect of boys who exercise their athletic powers. This, therefore, cuts him out of their normal circles and puts him with the street gang."

E. Ferri, in *Criminal Sociology* (page 8), writes: "Among murderers and thieves an incontestable inferiority has been noted in the shape of the head." This may be because the upper maxillary is not necessarily a facial bone, but because the two bones have been spread apart by the mandibular action in utero.

Drs. Kingsley and Talbot have made many researches into the mental effects of cleft palate, but they do not seem to have found that that particular defect is necessarily characterized by mental inactivity. I have myself met perhaps a dozen or more cleft palate cases, from ten years old upward, but they did not any of them impress me as being below the average in brain activity.

Almost all the crania examined are more or less abnormal, and one has but to notice carefully the illustrations of Cryer's Anatomy, which is nearly all original work done by Dr. Cryer, to see evidences of abnormality, and generally those evidences point toward a diminution in the width of the mouth, and even a seeming change in the position of the pneumatic spaces.

Dr. Wright also seems not content to copy the statements of the later anatomists, nor to accept the belief that the pneumatic spaces are not of any importance. I have had clinical experience in examining many children of not more than ten years of age, and can safely assert that an evident diminution in the size of these sinuses is always an evidence of serious functional derangement, either in the immediate vicinity of the nose and face, or in the more important organs, the heart and lungs.

Dr. Wright says anatomists claim that the majority of adults have deviated nasal septa, and I venture to add a little to that testimony. I spent five days in examining skulls in the Smithsonian Institution in Washington, and found only two septa which merited being called straight, and Dr. Herdlicka, the Curator, said he had not found any he could really call straight; and that has a distinct bearing, all the more from the fact that the majority of those skulls were of aborigines. Dr. Wright then calls attention to the 1907 edition of Morris's Anatomy, in which the positions of the cranial blood sinuses, continuous on the one hand with the meningeal veins, and on the other with the veins outside the cranial wall, are alluded to as emissary veins. The doctor points out the changes in air pressure taking place with each respiration. I think we owe an acknowledgment to Dr. Wright for calling our attention to these points, for it has been noted for ten or twelve years, or more, that whatever interferes with the physiological equilibrium interferes with the well-being of the individual concerned. While acknowledging my inability to discuss this matter from the standpoint of independent knowledge of the subject, I feel like saying to Dr. Wright, "I accept your views and acknowledge the correctness of your conclusions: I always knew it, but never thought of it before!" I have not known the anatomical fact shown by Ceuno and Andri that the peri-meningeal spaces communicate with the lymphatics of the nasal fossæ across the cribriform plate of the ethmoid. I am glad of an explanation of the meningitis following upon, or coexistent with, scarlet fever, which is given to us by pointing out the intimate relation between the lymphatics of the nasal fossæ and the base of the brain.

Dr. Baker. I talked so much yesterday about use and disuse, that if I am not careful I will say too much to-day. I just want to go over a little of what I pointed out yesterday, with reference to the muscular development, as I said little about the development of the muscles. Here we have a skull (indicating with a skull), and note at the base of the brain all of these eminences and processes. All of those processes are for a purpose. They are for the attachment of strong muscles, and they go up to the very base of the brain, and I believe that has a great deal to do with the development of that very important organ encased in the cranial cavity. I also believe that the use of the teeth, the utilization of the function of occlusion, has much to do with supplying that important organ with blood. I think the difference between a passive and an active blood stream is important; but I do not know. I think the use of these teeth bring a pure, arterial blood supply to the brain.

Now in private conversation with Dr. Wright this morning he has outlined a very basic experiment, but unfortunately that experiment has recently been undertaken by a Dr. Anderson, who is also a rhinologist. He lives in Detroit or Buffalo, I think. He closed the nasal cavities of some of the lower animals, and he found that he caused the same deflection of the cranial bones that I caused by interfering with the function of the teeth, and he found that the bones of the thorax were distorted similarly to the cases of my own. I have been in correspondence with Dr. Anderson, and I hesitated to mention the fact that there was a deformity in the bones of the thorax from my experiments. He said, "I believe you, because I have found the same result from my experiments." Another very interesting thing in Dr. Anderson's experiment is that when he closed the nasal cavities, and caused the animal to breathe through the mouth, in a short time the dogs operated upon became old animals. The hair came out, the skin became wrinkled, they were mangy and were subject to infection. A wound on one of them became septic, and the animal died of septicæmia. One of the animals went through the same process of aging, but the stitches in the nose pulled out, and in a short time the hair grew, the wrinkles came out of the skin, and he was a frisky young animal. That shows the importance of normal nasal breathing. This, and the functions of the oral cavity, are two of the basic principles of life, I think.

Dr. Federspiel. Mr. President: Dr. Wright's paper on "Malformed Bones of the Face as a Cause of Brain Inactivity," is instructive and interesting, because the doctor points out the value of equalizing circulation, and we learn of another reason why abnormalities of the mouth, jaws, and face should be corrected. Pathological conditions in any part of the body may retard circulation; for instance, endo-carditis may produce permanent heart lesions, and unless nature produces compensation, there will be venous congestion of the liver. I may cite a patient 24 years of age, who had been suffering from acute endo-carditis. Upon examination, we found heart lesions without compensation. A short time after that the liver became abnormally enlarged; this was due to passive congestion, a damming back of the blood. The patient became emaciated and weak, and was not active mentally because the circulation was interfered with. A disturbance of the circulation is brought on by many causes, such as arterial sclerosis, tumors, nephritis, adhesions, embuli, etc. While probably malformed bones of the face have a tendency to produce brain inactivity, we must not forget that there are many other causes which are strong factors in affecting the patient mentally. It behooves us therefore to always be careful not to make a snap-shot diagnosis. This frequently happens with dentists who call any disease of the mouth pyorrhea; it has become a fashion. To successfully treat patients suffering from mouth diseases, we must be able to make a differential diagnosis between stomatitis, syphilis, and other diseases, as well as to know the etiology, pathology, and prognosis. Then, and then only, can we begin to successfully treat pyorrhea and other infections of the mouth.

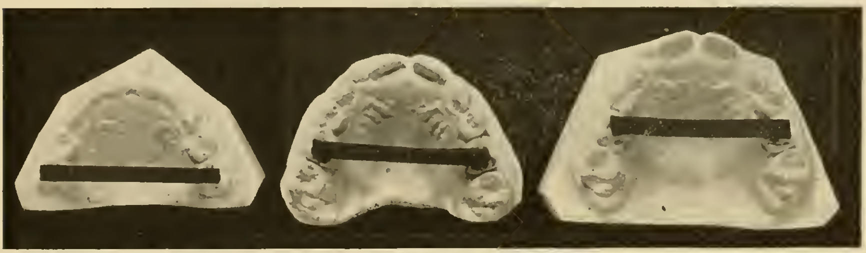

Fig. 1.

Dr. Hawley. This subject, as it has been brought out by Dr. Wright, is one of the most interesting and important that we have had before us in a long time. The question comes to my mind, that when satisfied as to the great influence of the teeth in mastication, can we make that so important as to induce a pleasure loving people to depart from their easy ways in the mastication of food (or absence of it), and get back into the habits necessary to develop the skull and brain to their proper proportions? I have been satisfied for a number of years that in the present habits of life of children, regarding the mastication of food through the time of development and use of the temporary denture, neither the temporary nor the succeeding permanent denture is developing, as we naturally have expected it would. All our authorities have taught us, and all their observations of prehistoric people have shown that the temporary denture grows laterally. Dr. Bogue pointed out some years ago that it did not, in two or three cases. I have gathered lately some further evidence on this subject that may be interesting. I have been fortunate enough to be able to inspect cases, which have gone over a period of several years without treatment, and I have been astonished at the results.

Here is a case (Fig. 1) which came to me something like five years ago; on the left is the upper temporary arch. The occlusion of the temporary denture was perfect, leaving out of consideration the presence of growth spaces. I made the models at that time for reference, and expected the case would be treated. It went on for three years; the model in the centre shows the condition at that time. The model on the right was made two years later. That was last June. I took pieces of black paper of the same length, and pasted them across the second temporary molar region. The width of these are practically the same. There is not enough difference to take into consideration. That arch should be something like 23-100 of an inch wider than it is, to form a normal arch. There has not been 2-100 of an inch growth in five years.

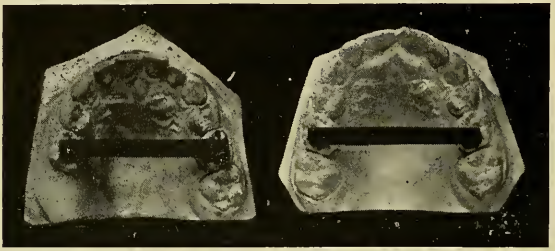

Fig. 2.

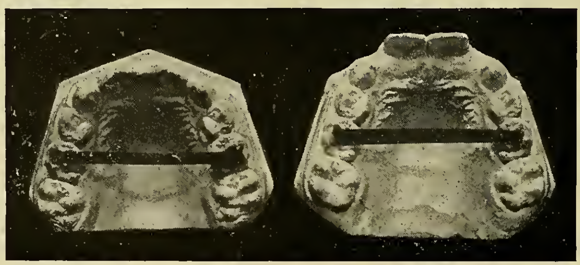

Fig. 3.

In looking at models, one should remember that a short arch always looks wider than it really is. Thus some of these cases, after the first permanent molars have erupted, look wider, when accurate measurement shows them to be of exactly the same width. So also when the first molars are in place, unless you keep in mind the appearance when the second and third have appeared, you are apt to be greatly deceived. The only safe way is resort to actual measurement.

Dr. Wright. Give the height of the arch on the left as compared with that on the right.

Dr. Hawley. I have no instruments to measure that accurately. I doubt if there is any difference.

Here is a case that came to me at the age of six. (Fig. 2.) On the left we have the upper temporary arch; only one permanent molar had erupted. The case came to me six years ago, and was not treated. There was distal occlusion, and I did not know what to do with it, so did not do anything. Three years later I began to treat it, and I took these models, and you see here again, during the three years there has been absolutely no growth in the temporary denture.

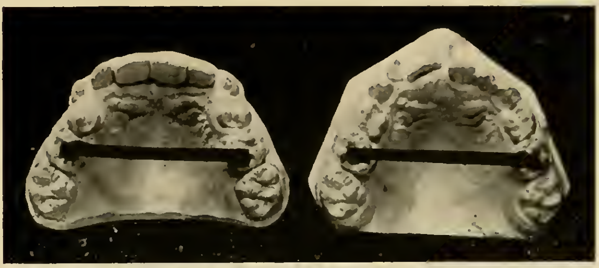

Fig. 4.

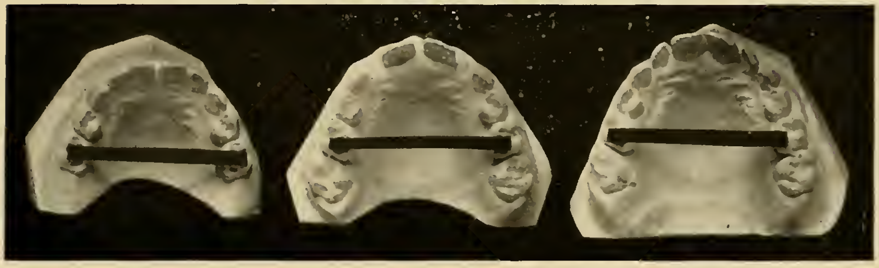

Fig. 5.

In Fig. 3, on the left, is another case at six. The first molars have just erupted. On the right is the case at 8. At this stage the case was treated, and the arch widened about 36-100 of an inch. It was a very extreme expansion. No growth whatever of the denture was noted in the temporary region.

The last two are cases of abnormal breathers. In Fig. 4 is the case of a child as normal as any I ever saw. She is the picture of health. One model was taken at seven years of age, and the other at eleven. There has been in this case a slight growth, probably 2-100 of an inch.

(Fig. 5.) I have not the complete history of this case as to breathing, etc., but my impression is she had an operation for adenoids. Beginning at the left are models taken at five, at eight and at ten years of age. There has been some growth, but it has been less than one-quarter of the amount of necessary growth, if we take as a standard the normal denture.

Fig. 6 shows a case at four and again at seven. In this case there has been absolutely no widening of the denture in three years' time. In length there was, if anything, a slight shortening, probably 1-100 of an inch. It was necessary to widen the arch 34-100 of an inch.

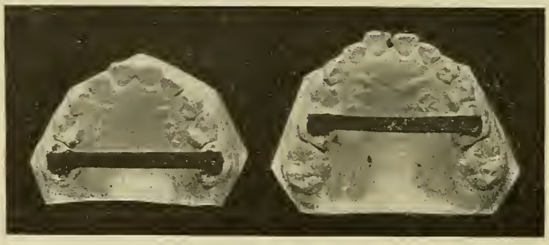

Fig. 6.

The conclusion I would come to is that with our present mode of living and the bringing up of children, lack of outdoor life, faulty mastication of food, etc., their dentures do not develop. Two of these are normal children and four are abnormal breathers.

Dr. W. C. Smith. This subject of lack of function and development, as brought out yesterday by Dr. Baker and today by Dr. Wright, has interested me very much. I have had an interesting case, the slides of which, unfortunately, I did not think to bring along. The case is that of a boy of twelve having decided and marked assymetery of face. The occlusion was normal on the left side, and on the right the temporary molars were in place as well as the sixth year molars; all were in decided infra-occlusion. The second temporary molar was impacted, being slightly below the lower first molar on the right side. The long side of the face was the side in infra-occlusion. The left side was the short side. On that side the occlusion was normal and the muscles were working normally.

The point made by Dr. Baker that normal function produces normal development is important, but in this case it seems as though it might be the other way. The long side of the face was the side in infra-occlusion, and the short side had normal function. Whether due to excessive ossification or the impaction of the temporary molars, I do not know. By using the elastic ligatures and drilling pits in the buccal surface of the temporary molars, and using from one to three rubber ligatures attached from the upper arch, ligated to the teeth of the upper arch, with hooks to engage the lower temporary molars, these teeth were erupted. The bicuspids are now well erupted, but the facial deformity remains. The boy seems to have had excessive ossification. A dentist tried to extract the upper temporary molar. He could not extract it. It may have been due to the excessive ossification. He has a large and exceptionally well developed mandible. He is thirteen years of age now, and this fall enters the high school.

Dr. Morehouse. I would like to substantiate Dr. Hawley's remarks as to lack of growth, etc. My own three little girls, the oldest now twelve years of age, the second one eleven, and the youngest five, have given me opportunity for making some observations. I have watched the cases very carefully. The older ones were developing malocclusion before I became interested in orthodontia to any great extent; but the five-year-old I have allowed to go on, and it may sound neglectful, but I did it because I wanted to follow the case and see the result. She had a tendency toward a very marked narrowing of the upper arch, as well as the lower, and the case went on for about one and a half years. I have not started it as yet, but will do so on my return. The arch has narrowed continuously during the past one and a half years. There has been some slight nasal obstruction, and the tonsils are enlarged. The other two girls are in perfect health, and have been since they were babes, and there has not been a particle of decay in the temporary teeth. Under-development has occurred in four or five years of time. Although there was normal occlusion mesio-distally, there was lack of development buccally. When the incisors began to erupt, I had to expand the arch and correct the deformity.

Dr. Federspiel. In growth there is a period of rest and a period of activity, and we must not confuse that with metabolism, which is normally constant.

Dr. Hawley. When are those periods?

Dr. Federspiel. No one knows, but we do know there is a period of growth and a period of rest. Men confuse that with metabolism.

Dr. Baker. While that case of Dr. Smith's is fresh in my mind, I would like to say that with a rabbit we had the same thing. One side functionated and the other did not in Dr. Smith's case, and the longer side of the face was the disused side. I will show something of the same kind in the case of the rabbit. (Showing slide.) This is the operated-on side—the right side.

The left side is the normal side, and note that the inactive side is longer than the active side, which bears out the theory of Dr. Smith.

Dr. Ottolengui. Did he not speak of the vertical length, from the top of cranium down?

Dr. Smith. The length of the face vertically was greater on the unused side than on the normal side.

Dr. Baker. Although this does not quite prove the theory, nevertheless the operated side is longer than the other, but longer in a different way than stated.

Dr. Wright. It would be impossible to answer all the questions, or take up the statements of the different speakers separately. I will take up the most essential points brought out, however. In nasal obstruction we can write volumes of the reflexes that influence different parts of the body, of the different detrimental things, but we will try and stick to those that cause brain inactivity. There is one other thing I will refer to. Dr. Bogue and Dr. Baker spoke of the malformed chest walls found during their experiments. It would be interesting for either of you to secure a book on *Physical Diagnosis,* by Charles Lyman Greene, of St. Paul. He gives in that book a photograph of the typical mouth-breather. He gives also some malformed chest walls and malformed spinal columns, which are interesting. He figures that all pigeon-breasted children will be found to have had during the developmental stage, trouble with the nasal passages, and that the malformation of the chest is generally a sequela of such conditions. Dr. Bogue points out that malformations are produced from a lack of functional development. I think he has hit the nail on the head. Exercise and get away from this nice, dainty way of living in which the children are not to be asked to exercise themselves. Make them work: work develops them.

Speaking of Dr. Cronin made me think that he found in his statistics of the school children of New York, in an examination of 99,900 children in Manhattan, that about ten per cent. were afflicted with nasal obstruction to such an extent that they should be operated on. The greatest proportion were suffering from nasal obstructions, causing the various eye diseases, etc.

Dr. Bogue referred to the straight septum. The cases I referred to were those deviated to such an extent that they could be benefited by an operation. I find no perfect specimens of anything anatomical that I have ever seen. The development of the arches, as illustrated by Dr. Hawley, was very interesting to me. I have been watching some of the models from Dr. Ketcham's office with relation to this same condition.

The Radiograph in Orthodontia.

A. H. Ketcham, D.D.S., Denver, Colorado.

The Roentgen ray in combination with the photographic emulsion has proved of great value to the physician and surgeon, and as the conditions confronting the orthodontist in diagnosis are often quite as obscure, I believe that orthodontists generally would find it of great advantage to make more frequent use of the radiograph. Not only in determining whether an unerupted tooth is present, or to show its position when present, is the radiograph invaluable, but as we will see later, it may be possible to settle some questions about methods of treatment which have caused considerable discussion in the years gone by. Indeed, in many cases an accurate radiograph is just as necessary in diagnosis, and in the record of a case, as are accurate models.

I remember a case, a girl of fourteen years of age, who was referred by one orthodontist to another after the former had about half completed treatment, in which the left upper temporary cuspid was still in place. A radiograph had not been made, as the operator took it for granted that the permanent cuspid would erupt normally some time. The suspicions of the second orthodontist were aroused and he made a radiograph with the result shown in Fig. 1. You can see that the impaction of this cuspid would increase the difficulty of the treatment of this case to such an extent that the price of even a splendid X-ray outfit would not compensate the operator for the extra labor involved.

Unfortunately, orthodontists are not always situated so that they can secure the services of an operator who makes good dental radiographs, and, without fidelity to detail, a radiograph is practically worthless. Accuracy is a question of perfect technic and good judgment and is not too difficult for any careful operator to acquire. It is not surprising that orthodontists have been unable to find an operator competent to make accurate dental radiographs. The technic required to make these radiographs is quite different from the technic of those needed by physicians and surgeons, so how can we expect the physician, though he may be successful with radiographs in his line, to succeed, when he is ignorant of our needs and the technic required in this special part of X-ray work? Do you wonder then, that many orthodontists have nothing to show in their most interesting cases, but radiographs with blurred outlines of the teeth, with roots lengthened out of all proportion to normal, inaccurately showing the relation of an impacted tooth to its neighbors, and valueless for a study of the adjacent tissues? Fortunately, the technic now is so simplified that the physician, with a little instruction, may meet our needs, or the orthodontist may master the technic and make good radiographs of his cases as easily and as accurately as he makes good models.

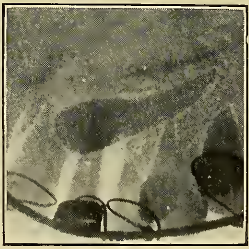

Fig. 1

The Generator. Our first consideration in attempting radiographs is the generator. It is composed of an induction coil, an interrupter and a tube. It is best to have a coil giving a good reserve of power, say one with a 12-inch spark gap, which will give at least an 8-inch, or better still, a 10-inch white fuzzy flame between the terminal points. The electrolytic interrupter is best, because it permits of a shorter exposure than the mechanical interrupter. An extremely short exposure may be made with a multiple point interrupter. Green and Baur, of Hartford, Connecticut, make a very satisfactory self-regulating tube which they call the Clover Leaf.

I use the 6-inch size. It is well to use a milliampere meter which gives the amount of milliamperes used in the tube.

Stand to Support Tube.

A rigid stand should be used to support the tube so that it will not vibrate and destroy the sharpness of the radiograph. One end of the tube may be supported by an additional stand, which is made very easily by taking the wooden arm which supports the tube, from a regular stand, telescoping this in a piece of brass tubing which stands vertically on the floor, having a thumb screw inserted in same. The arm can then be adjusted to the tube by running up and down in the brass tube and locked by the thumb screw the proper height to reach the unsupported end of the X-ray tube (Fig. 2 A). This will make the support of the tube more rigid, which is very essential in obtaining fine detail on the film, especially when the heavy shield is placed around the tube, as well as lessening the danger of breakage to the tube.

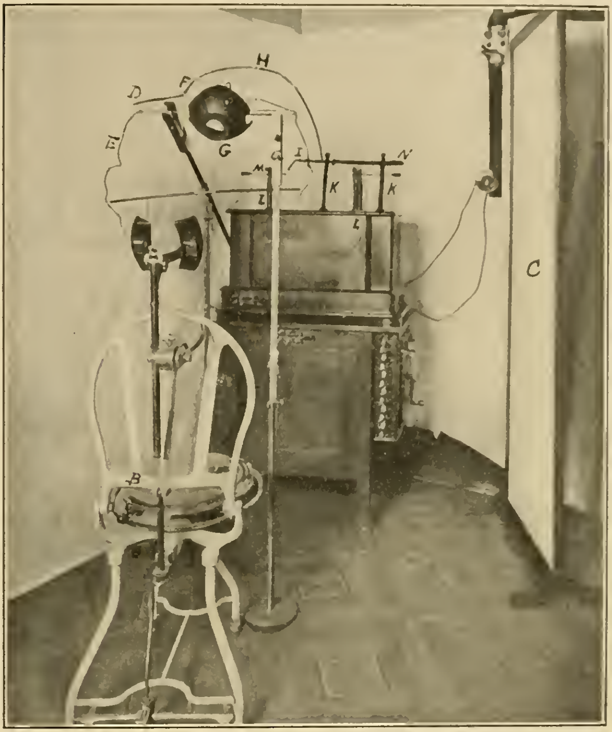

Fig. 2

The Chair.

The chair for the patient is important. A dental operating chair is good, but an adjustable chair, having a head rest, which is made for the use of rhinologists (Fig. 2, B), is less expensive, takes up less space and is more satisfactory than the dental chair, as it may be turned around easily so that either side of the patient's head may be presented to the X-ray tube.

Proper Vacuum for the Tube.

The X-ray outfit should be in a room which may be darkened easily so that the operator may observe the color of the tube.

It is impossible to give instructions by words only, so that a person may acquire a knowledge of the proper working vacuum for a tube, for such knowledge—like that of the proper density for an ordinary photographic negative—is only acquired by experience; let me say, however, that the usual way of determining the vacuum of the tube is by observing its color while in operation, the operator standing behind a lead screen which is placed behind the tube and looking through a bull's-eye of lead glass (Fig. 2, C).

The tube contains a platinum target called the anode, in the center of the sphere, with an aluminum disc at the end opposite, called the cathode. When the tube is filled with atmospheric air, as before it is exhausted, or when punctured from use or abuse, there is a violet stream or spark between the cathode and anode when the tube is connected with the coil—just the same as the discharge between the terminal points upon the coil when the tube is disconnected. When the tube is exhausted to a partial vacuum, just a light gas remaining, then connected to the coil in the proper manner, there is a well defined light in that half of the tube in front of the target or anode. The color of this light is perhaps best described as yellow when the tube is at the right degree of vacuum for good dental radiographs. When the vacuum of the tube is too low, a violet color will be seen behind the anode and around the cathode. If this appears while the tube is in use a puncture is liable to result unless the current be shut off at once. In such cases the teeth and bony tissue will give heavy black shadows with lack of detail. If the color of the tube is bordering on greenish, the vacuum is too high and the rays have such a high velocity that they pass through the bony tissues, of slight difference in density, like a bullet from a high power rifle, and do not leave much differentiation of contrast between the hard and soft tissues upon the film emulsion; while if the vacuum of the tube is just right, the teeth and alveolar process stop the rays enough to give good definition of the different tissues of the teeth and the cellular structure of the alveolar process upon the photographic emulsion.

This can be determined by the operator noting the color of the tube when he does secure a good radiograph and adjusting it the same, each succeeding time. A regulating vacuum tube should be used in all cases in this work to maintain the vacuum at a constant point. They are adjusted by a wire which extends from a projection upon one side of the tube out near the cathode wire running to the coil (Fig. 2 D). As this adjusting wire is brought near the feed wire to the desired distance, then the current turned on through the coil, a sparking will take place from the adjusting wire to the nearest feed wire (Fig. 2 E), which will reduce the tube to the proper vacuum, after which the film may be placed in the mouth and the exposure made. Sometimes it may be found difficult to reduce the tube; when that is the case the feed wire (Fig. 2 E) may be connected direct to the little metal ring (Fig. 2 F), to which the reducing wire is attached, then the current thrown in and pulled out of circuit as quickly as possible; this will reduce the tube to a violet color, but it will go up to the proper working density very quickly when the wires are adjusted for work.

Perhaps the best way to reduce the vacuum of the tube is to have a third wire (Fig. 2 H) connected to the projection upon the tube, which holds the usual vacuum regulating wire (Fig. 2 F). This wire is run back to the coil and fastened to a brass rod (Fig. 2 I) having a long hard rubber handle (Fig. 2 N). This rod may be supported by posts of hard rubber (Fig. 2 K) in a horizontal position lengthwise of the top of the coil and about six inches back of the secondary binding posts (Fig. 2 L). The brass rod is short, so that it extends but half-way between the terminal posts upon the top of the coil, but is joined to the rubber handle in the center and the wire is also connected to the brass rod at this point. To the outer end of the brass rod (Fig. 2 I) is attached a brass wire of about 16 to 20 gauge, which may be bent towards the terminal (Fig. 2 M), then when the tube is in operation and the third wire connected with the adjusting wire upon the tube, a sparking will take place between this wire and the terminal by the current passing from the tube through the third wire, the brass rod (Fig. 2 I) and its wire terminal to the terminal point (Fig. 2 M) upon the coil; thus the discharge of sparks will be back by the coil, between I and M, and not alarm the patient as when it occurs up by the tube, and besides the tube seems to run more evenly with the discharge having taken place back upon the coil. I am indebted to one of our prominent X-ray operators, Dr. S. B. Childs, for this suggestion. Different devices to accomplish the same result are used by coil makers on the later coils.

The spark gap may be adjusted by bending the wire at Fig. 2 I or moving the handle (Fig. 2 N) away from or closer to the terminal (Fig.

2 M). Of course, the adjusting wire (Fig. 2 D) upon the tube must be bent away from the wire (Fig. 2 E) a greater distance than the spark gap from I to M, otherwise the current following the path of least resistance will reduce the tube by travelling from D to E.

It formerly was the custom of some operators to look through the fluoroscope at one of their hands to determine the working condition of the tube. As many serious X-ray lesions have resulted from this practice, the operator who does this is, to say the least, foolhardy.

Duration of the Exposure.

The duration of the exposure should be within ten seconds, according to the volume of the current used, the vacuum of the tube and the thickness of the tissues. For instance, the lower teeth in a young child's mouth would require the minimum exposure; the upper teeth a little longer time, while in an adult the exposure of the upper molars through the thick process, zygomatic arch and muscles would require the maximum of time. With the powerful apparatus used today, the exposures may be made in a fraction of a second.

Head Radiographs.

For radiographs of the head I designed a plate holder which clamps on the head rest of the rhinologist's chair. The head rest is adjusted so as to bring the patient's head in position with the plate holder against the side to be radiographed; the tube is placed horizontally eighteen inches from the plate.

For radiographs of the temporo-mandibular articulation, the best position is with the anode of the tube just below the level of the mandible. The radiographs for the temporo-mandibular articulation with the coil drawing about twenty-five amperes, and the tube adjusted properly, should not require over thirty seconds, but may vary according to conditions and is only determined by experience.

The Film.

Next in importance to the generator is the photographic emulsion and the vehicle by which it is carried to the mouth. The best article that I have seen upon this subject was one by Dr. Weston A. Price, of Cleveland, which was published in the March Items of Interest, and I can do no better than to quote from this article:

"The difference in the densities of the dental structures between which we must produce photographic contrasts is so slight that it makes it practically impossible to get choice results with ordinary photographic film. We must pile up the light contrast by using several layers of emulsion on the same film. Nearly four years ago I put a great deal of work on the production of such a film which has given excellent success and I believe is in general use for this work and is being manufactured by the M. A. Seed Dry Plate Company of St. Louis. It has three layers of emulsion, one upon the other and all are acted upon at once by the X-rays. It can be secured from them direct by specifying my name, or by asking for the special dental film. The celluloid is thick enough to prevent curling and yet sufficiently flexible for the purpose and is selected from specially prepared smooth polished stock, free from scratches. The conditions under which we use it require it to be covered with a waterproof, lightproof, flexible container, and for this purpose I have found nothing so satisfactory and convenient as the unvulcanized black rubber, which can be secured at any dental supply house."

I order the film, described by Dr. Price, in sheets four and three-quarters by five and one-quarter inches in size. Take two sheets of Klinert's unvulcanized black dental rubber, remove the cloth and place side by side with the edges slightly overlapping; this sheet is then about an eighth of an inch larger than the size of the film. Then take a sheet of the film and place it face to face, or emulsion to emulsion, on a sheet of sensitive bromide paper, or a sheet of film of the same size, so that the rubber will not come in contact with the sensitive emulsion of the film and cause it to deteriorate. (Paper will also cause the emulsion to deteriorate.) Next lay both on the rubber, then another sheet of the unvulcanized black rubber of same size as first is placed on top of all and the edges pinched together around the edges of the film. This makes a light and moisture-proof envelope which may be cut into smaller sizes and the edges of the rubber pinched together as cut; if this is done in a warm room the edges of the rubber will adhere quite tightly. Snip the corners of the film and pinch the rubber together over them.

This work must be done in a dark room, using a very weak ruby lamp, and even this light will fog the film if it is exposed for a sufficient length of time. It is also best to place the prepared film back in the tin box which contains the sheets of rubber and put the pieces of cloth in between the rubber envelopes to keep them from sticking together. It is very essential to keep the film in a lead lined box, as otherwise the X-ray will fog it, for the rays will pass through an ordinary wall or even a brick wall, and fog the plates. In an emergency I have used Kodak film doubled upon itself, covered with unvulcanized rubber and cut up as desired; but as Dr. Price explains, there is not sufficient body of emulsion to give good contrast. I have also cut up Kramer's X-ray plates and covered with rubber after placing the bromide paper over the emulsion, and have secured good results, but a piece of glass is too unyielding to use satisfactorily in the mouth.

The Envelope. The rubber envelopes, however, are rather unsatisfactory in one particular, for unless great care is used to pinch the edges of the rubber together tightly around each small piece of film, they are apt to pull apart and allow light to fog the film; also should one rubber envelope touch another the two will be quite apt to stick together with the likelihood of tearing the envelopes and thus fogging the film when they are pulled apart; but it has the advantage over the paper envelope of being moisture-proof and having rounded corners instead of square. A good light and waterproof envelope with round corners, which would fit the edges of the film quite closely so as not to occupy an unnecessarily large space in the mouth, would, I believe, be superior to the rubber in that it could be used. in the film holder to greater advantage.

Danger in the X-Ray. There is grave danger to the operator who is continually exposed to the influence of the X-rays, for the reason that the effect of the rays is cumulative, so that one dose piled on top of another will eventually cause serious trouble. In the early days of the use of the X-ray the operators did not realize this and some lost their hands, and a few their lives, from working under the influence of the ray. Nowadays no X-ray operator, who has had enough experience to realize what he is doing, will subject himself to an exposure while making a radiograph, and all the operators with whom I am acquainted refuse to make an examination by the use of the fluoroscope, unless thoroughly protected by a lead screen. I am sorry to say that some of my orthodontist friends, in their eagerness to secure good radiographs, have held the film in the patient's mouth, thus being exposed to the rays each time that patient was exposed. I wonder what you would think of a physician who would take a dose of medicine each time every one of his patients did? I must confess that I was quite careless when I first began to make radiographs and used to hold the film in the patient's mouth when making an exposure, and also would look at my hand through the fluoroscope to determine the working condition of the tube. Finally my hands began to feel as though they were suffering from frost bite. after making several exposures in a day, and I was obliged to give up holding the film in the patient's mouth and to design a dental X-ray holder for this purpose.

It would require too much time to enumerate the many cases of burns which have resulted to the operator from this continued exposure. In my own case I seem to have escaped with no more serious effect to my hands than numerous warts and ribbed finger nails. I have been able to remove all of the former except one, by cauterization; but many operators have not been so fortunate, one of my friends having had over forty operations upon his hands for cancers, caused by repeated exposures to the X-ray. Mr. Baur, of Green & Baur, of Hartford, Connecticut, who were probably the first in this country to make a focused tube, was constantly exposed in the early days of the X-ray, as was his partner, Mr. Green. They noticed that the skin upon their hands was irritated, but did not attribute it to the X-ray until they saw a newspaper account of an X-ray burn. This set them to thinking, and they began to treat their hands, but in the case of Mr. Baur it was too late, and his life was sacrificed to the cause of good X-ray tubes. Mr. Green was more fortunate, but was obliged to visit a physician every evening for seven years to have his hands dressed, cauterized, etc. To-day the only good piece of skin upon his left hand is one about the size of a silver dollar, which, after a cancerous growth had been removed, was grafted from his thigh. He also had a cancer between his eyes, which had penetrated one frontal sinus and gone on through the skull until it had all but reached the brain. Mr. Green was treated by Dr. C. A. Porter, surgeon of the Massachusetts General Hospital, who published a description in pamphlet form of the treatment in forty-seven cases of X-ray lesions. I think that a copy may be secured by addressing him at 254 Beacon St., Boston, Massachusetts. There are also a number of reputed instances where the X-ray operator has been made sterile from the influence of the X-ray; so, knowing all this, the operator is foolhardy to expose himself to the ray when he can be protected.

Danger to the Patient.

With the short exposure of the present day, the danger to the patient is nil, for the patient is exposed to the rays but two or three times, where the operator would be exposed hundreds; yet people have been burned and crippled for life with but one exposure. Most of these cases happened during the early days of this work when the danger was not understood and when the apparatus was not nearly as efficient. When I first started experimenting with the static generator, it required eight minutes to make a proper exposure in the upper bicuspid region, while to-day it seldom requires as many seconds. We are using a larger volume of current and making the exposure but a fraction as long as formerly. The operator has no right to take unnecessary risks of injuring a patient. It is possible to protect a patient so that the only part exposed is the one which we wish to radiograph, and this should always be done.

Protection to the Operator.

In making dental radiographs, as I have indicated, the operator often has held the film in the patient's mouth with his own hands, receiving the same dosage as each and every patient. Other operators have tried to have the patient hold the film, but usually with very unsatisfactory results, as the film would either not be held in the proper position to give the minimum amount of distortion of the roots, or it would slip out of place. The results were very unsatisfactory indeed.

Dr. Weston Price devised opaque rubber gloves, sleeves and apron made of rubber cloth, into which there seems to be incorporated some metallic oxide, but these do not cover the operator's person perfectly, and I cannot see what it would profit a man to save his hands and burn an arm or his head, and it has been reported that some operators have had their feet burned while standing behind a lead screen which did not reach quite to the floor; besides the rubber gloves are so thick and clumsy that it is practically impossible to hold the film satisfactorily in the patient's mouth. Some operators have gone into the matter of protection very thoroughly, having constructed a lead lined booth or box, in which are placed the switches to operate the X-ray generator and having a small window of lead glass through which the operator may watch the tube and patient. This is probably the most perfect form of protection to the operator. Others are using a screen which is covered with X-ray lead of the proper thickness to completely stop the rays. The operator can stand behind this screen and operate the switches and watch the tube through a lead glass bull's-eye, in comparative safety, for the rays are direct rays and cannot be deflected.

Protection to the Patient.

To protect a patient, the physician will often place a metal box or lead glass shield around the tube. The tube for general work over the body is usually placed in a horizontal position, with the anode turned down so that the rays are projected toward the floor. Beneath the tube and eighteen or more inches from the anode is placed the plate, and over that the part to be radiographed. In the case of a body radiograph, the compression diaphragm is used between the tube and the part to be radiographed; this not only cuts out secondary rays but it presses the patient's body down, or irons him out thinner, so that a better radiograph is secured, and when a lead glass shield is used in conjunction, the only part of the body exposed to the influence of the rays is that of which the exposure is being made; but in dental radiographs it is different; instead of lying on an operating table the patient is sitting in a chair—unless the operator has a compression diaphragm tube stand—and the tube is elevated to the proper height to make a radiograph of a certain tooth. The most satisfactory method of protecting patients that I have found, after considering the different ways of covering the patient's body and face with an opaque cloth, or with a lead sheet having a hole placed over the area which we wish to radiograph, has been to use a Price shield, made of heavy rubber compound (G, Fig. 2). This shield is flexible, and by cutting off the part which goes over the back of the tube, it can be put on and removed from the tube quite easily and tied in position with tape. It has an opening about three inches in diameter, over which fit a series of stops or diaphragms down to about three-fourths of an inch in diameter. This cuts out all the rays going toward the patient except those which pass through this small opening to the surface which we wish to radiograph. The anode of the tube is turned toward the tooth to be radiographed with the tube in a horizontal position and its long axis parallel, as nearly as possible, to the surface of the film. You must remember that most of the rays are projected from the front of the anode, not as many going back toward the operator, but back of the tube by the switches, a lead screen is placed, behind which the operator stands.

I have made hundreds of dental radiographs, a number of the head and other parts of the body, and have been so fortunate as never to have a patient receive a burn.

Film Holder.

Apparently I am not as susceptible to the influence of the X-ray as the majority of operators, yet I have reached a point where I do not dare expose myself to the ray at all, and will not now do it. When my hands began to trouble, as mentioned previously, and friends were advising me to give up the work entirely, I began to cast about for a way of holding the film in the patient's mouth which would eliminate all danger to the operator, be easily adjusted for different positions, and still hold the film in close relation to the tissues just as though the operator held it with his fingers. After considerable experimenting, I devised a holder which is illustrated in Fig. 3.

This holder is composed of a rubber block, which is designated as (14) in the illustration, the rubber block to be held between the teeth, and to prevent slipping velum rubber is vulcanized to the upper and lower surfaces. The block has a horizontal slot (16) in its central portion through which a bolt (13) having a winged nut (19) is passed. The inner end of the bolt is to receive the arm (10) of the aluminum film holder (5). The arm has a slot (12) cut to pass underneath the

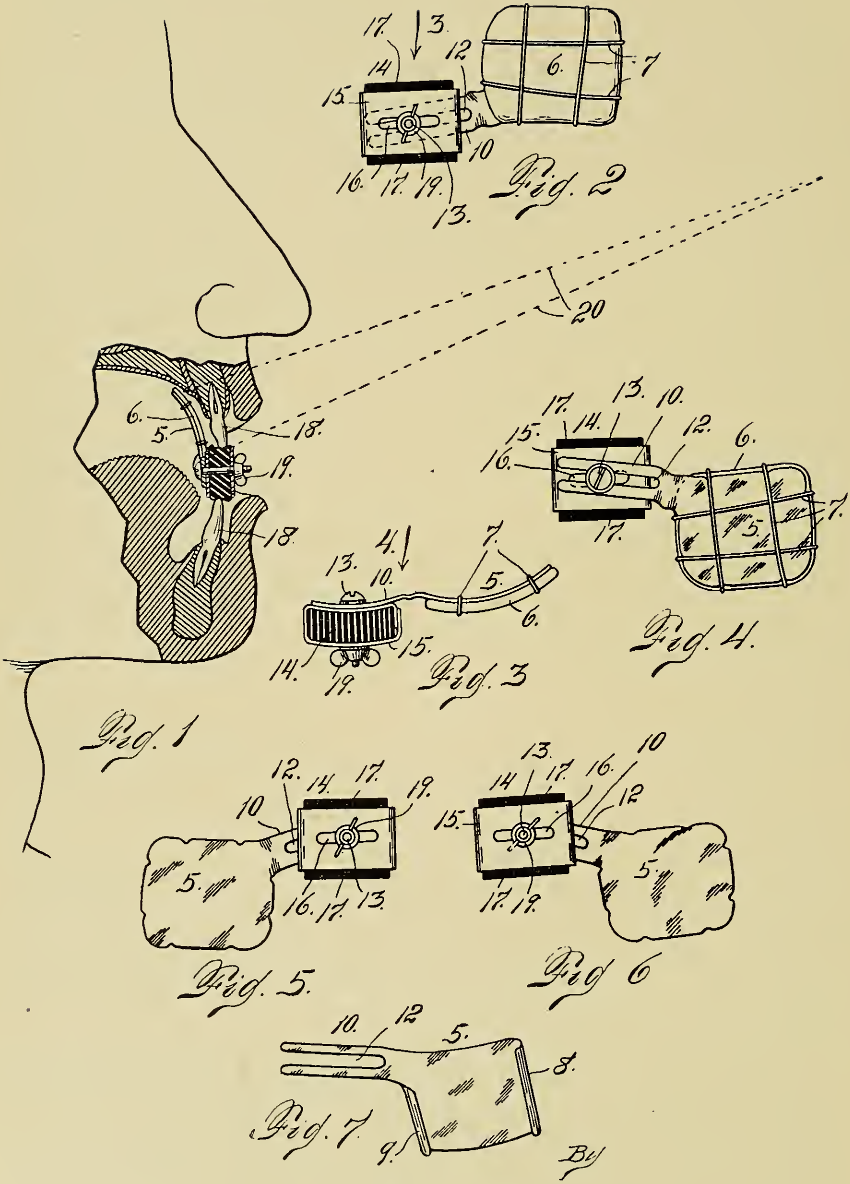
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Fig. 3

head of the bolt (13), then when the nut (19) is tightened the aluminum holder (5) is fastened securely to the rubber block.

Several different sizes and shapes of the aluminum holders may be fashioned for the different sections of the mouth which we wish to radiograph, but in practice these may be simplified to about four forms, each set in three different sizes, as a certain shape which would hold the film for the right upper. molars and bicuspids, would with a little bending, hold it for the left lower molars and bicuspids—and the same is true of the opposite sides of the upper and lower arches—while another shape may be used for the upper or lower incisors, though it is best to make these in lefts and rights, as it is desirable to keep the rubber block near the front of the mouth when radiographing in the region occupied by the lateral incisor, cuspid and first bicuspid.

The holders may be made of aluminum plate of about 20 gauge, which is flexible enough so that the holder may be bent readily to conform to the tisues and the handle bent in and out to adjust the holder to the correct angle. The anterior and posterior edges of the holder may be bent over to receive the edges of the rubber envelope which contains the film, but there is some danger, unless the edges of the rubber are very carefully pressed together, of pulling the edges of the rubber apart and partially fogging the film. The film holder may be flat, with notches in its edge and a rubber band, a size larger than the election bands, slipped around the films and holder.

With a little experience this film holder may be adjusted to different positions in the mouth and even carried back between the tongue and the teeth to radiograph the third molars. If the patient is instructed to raise the tongue and then the film holder slipped in beneath the tongue, passing downward and back, it will lay close to the tissues to be radiographed.

Some of my friends have been waiting for the appearance of this film holder on the market. To these I owe an apology, for besides trying it out in difficult cases and with hard usage, I have been too busy with other work to arrange for its manufacture, but intend that it shall soon be possible for all X-ray operators, who may desire, to secure one.

The Position.

The film in its moisture and light proof envelope is slipped upon the aluminum holder which carries it to the desired position close to the tissues which are to be radiographed. It is known that the closer the film is to the tooth or tissues which are to be radiographed, the more accurate the result, for a radiograph is but a comparative study of the shadows of tissues varying in density, so the closer we can place our photographic emulsion to the object which we wish to radiograph, the sharper the

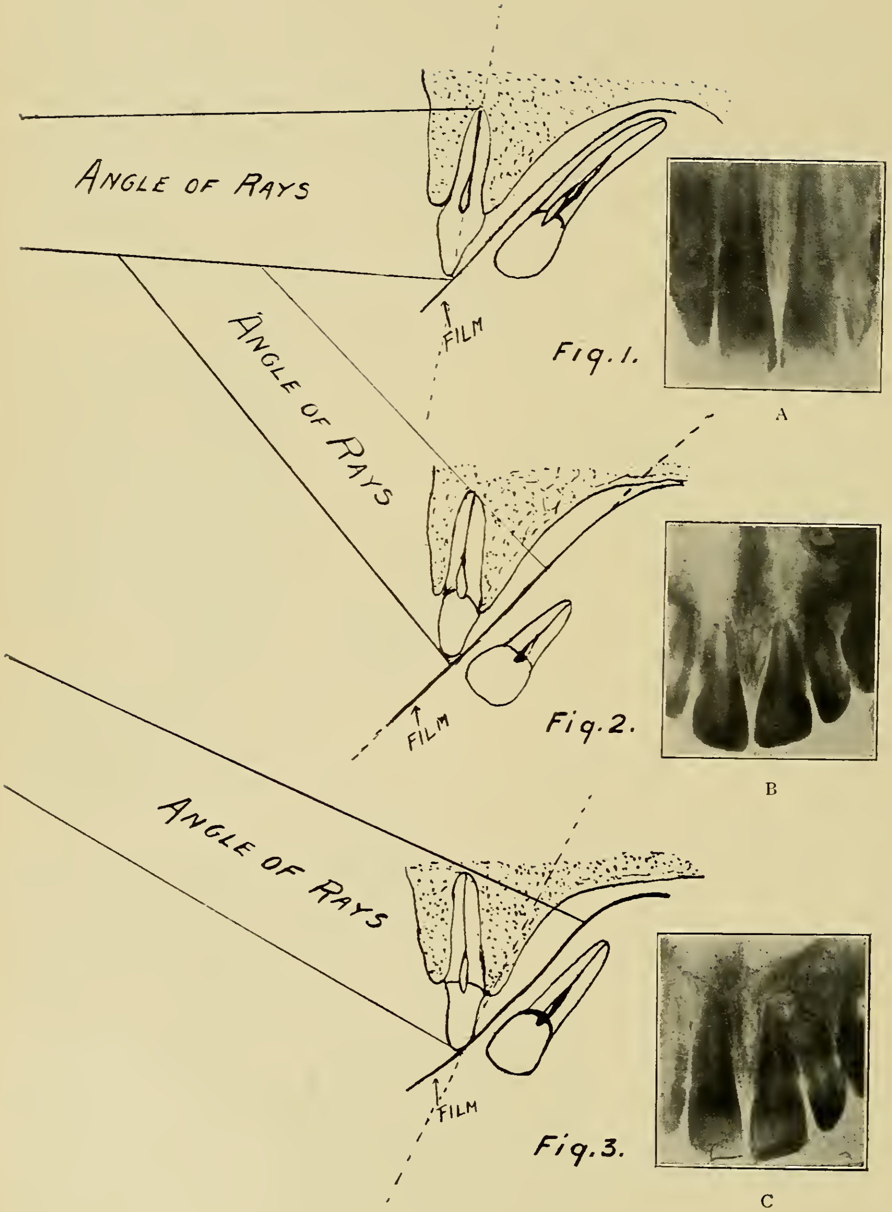
ANGLE OF RAYS
FILM
Fig. 1.
A
ANGLE OF RAYS
FILM
Fig. 2.
B
ANGLE OF RAYS
FILM
Fig. 3.
C

Fig. 4

shadow. You can very easily prove this by holding a finger between a sheet of paper and some artificial light. You will find that the closer you hold your finger to the paper the sharper the outlines of the shadow, and that upon moving the finger away from the paper this sharpness disappears in proportion as the distance increases. This holds true in our radiographic work: in the making of radiographs of the lower teeth we can secure the most accurate representations by running the film down between the tongue and teeth so that it is parallel to the long axis of the teeth; but this is not the case in the upper arch, for if the film is placed parallel with the long axis of the teeth. the upper edge touching the wall or roof of the mouth some distance from the apex of the roots, will cause the film to be held quite a distance from the crowns of the teeth so that the image of the crowns will not be as sharp. Dr. Price explained this very nicely in the article from which I have quoted. and I have his permission to use his illustration. which is the best that I have ever seen, showing the relation of the tube to the upper teeth and the film. (Fig. 4.)

Dr. Price says: "We all know how seldom our own shadows represent our true height or shape because the source of the light and the surface receiving the shadow are not in the proper relation to the object casting the shadow. Each of these three factors must be in correct relation to the other two. but one of them. the teeth and surrounding structure casting the shadow, are by their peculiar position practically fixed and the others must therefore be adjusted to them.

"The shape of the arch prevents one placing the film in the best position to receive the shadow. viz: in parallel planes. This produces a distortion which must be overcome by placing the source of the light in just the position that will shorten the shadow just the extent that will correct the elongation of it produced by the film not being in a parallel plane to the roots of the teeth."

In Dr. Price's illustration Fig. 4. No. 1 shows the result of taking a radiograph with the tube opposite and at right angles to the long axis of the teeth. and shows the distortion by elongating the shadow of the roots just as our shadows are distorted upon the sidewalk when the sun is low in the sky. The film in this instance is adapted as closely to the tissues upon the lingual side of the teeth as possible. Fig. 4. No. 2 shows the distortion caused by placing the tube so that the rays will fall at right angles to the plane of the film. thus greatly shortening the shadow of the roots. just as our shadows are shortened at noon in the summer time when the sun is almost directly overhead. Fig. 4. No. 3 shows the correct position of the tube in its relation to the teeth and the film; that is, the tube just half way between the positions which it occupied in the two first illustrations, so that the rays fall at right angles to a plane drawn midway between that of the long axis of the teeth and of the film and giving the correct length of the roots of the teeth upon the film.

Position seems to have been a great stumbling block to our medical friends who have tried to make dental radiographs. If we will but remember the simple rule of having the tube elevated just enough in our radiographs of the upper teeth so that its rays fall at right angles to neither the teeth nor the film, but to a plane drawn midway between them, and then if a film holder, which holds the film close to the tissues to be radiographed, is used, the difficulty experienced in distortion of the image will be practically eliminated.

Some patients will flinch or jump a little when the current is first turned on through the tube. Of course this motion will produce a "fuzzy" radiograph just as it will produce a "fuzzy" image when photographing a face; so it is well to first turn on the current for a second or two to allay their fears, then the film may be placed in the mouth and the exposure made.

Stereoscopic Radiographs.

Stereoscopic pictures of the teeth and jaw may be made satisfactorily. For this purpose efficient apparatus has been devised by the different X-ray equipment manufacturers.

Radiographs of the Head.

In making radiographs of the temporo-mandibular articulation it is only possible to secure one side accurately upon the plate at a time. In experimenting with the skull to find the best relation of the anode of the tube to the mandibular articulation and the plate, in order to secure the most accurate radiographs, I made exposures upon plates from three different positions. One a bull's eye opposite both temporo-mandibular articulations. Another with the tube raised so that it was above the temporo-mandibular articulation and with the anode turned down so that it pointed toward the side against the plate. Another plate was exposed with the anode of the tube at a point just below the mandible and showing the temporo-mandibular articulation nearest the plate quite sharply. The last seems to be the best position.

Development.

Do not send X-ray exposures to a photographer to be developed unless you wish to court failure, for the technic is quite different from ordinary films or photographs; then, too, you cannot be as certain of the cause of failures and learn how to guard against them.

I have used Ortol and several other preparations in developing Seed's

Dental X-Ray Film, but find that the Eikonogen developer answers my purpose the best. Made as follows:

Sodium sulphite, three ounces.
Potas. carbonate, two ounces.
Eikonogen, two ounces.
Aqua, two quarts.
Dissolve in boiling water and filter when cool.

Secure fresh pure chemicals in original packages from photographic supply house.

One part of the developer is used to two or three of water; temperature about sixty-five in summer and not over seventy in winter. If the exposure is normal it is best to give the film twenty minutes in this developer. In order to bring out the contrasts and have the developer act upon the three layers of emulsion, it is best to use weak developer, as I have indicated, and carry on the development for a longer period. The bromide paper may be developed in the same solution, but as the detail is not very sharp it is usually best to throw it away.

The emulsion is so thick that the image of the teeth cannot be seen by looking through the film at the ruby light, but by looking down upon the emulsion the image of the teeth will be shown; but it is best to keep the tray covered or protected from the ruby light by some screen like a piece of cardboard until development is completed.

With a little experience the operator, knowing the density of the tissues radiographed. the length of exposure given and the strength of his developer, can tell how long to leave the film in the developing solution to obtain the best results. After the film is developed and rinsed, it is placed in an acid fixing solution which hardens the emulsion as well as fixing. Then the films are placed in a large tray and washed in gently running cold water for an hour; they may then be rinsed to wash away any minute specks of detached emulsion which may be upon their surfaces, then stood on edge upon a blotter in a tray to dry.

Lantern Slides. From a good radiograph fine lantern slides can be made by contact exposure. It is best to rather under expose the slide and bring up the image carefully in development. The glossy velox paper makes excellent prints from good radiographs.

Things Proved in Orthodontia by Use of the X-Ray.

Here are some of the facts which I think I have proved by the use of the X-ray. We were told years ago that the bone is absorbed in front of the moving tooth and that new bone fills in behind the tooth. Of course this is true to some extent, but the greatest change is in the bending out of the labial alveolar plate in the outward movement of several teeth, and a stretching of the weaker portion of the alveolar process, which is the cancellated structure of the bone in between the plates and between the tooth sockets. Dr. Frederick B. Noyes first suggested that this was probable, and I think I have proved it in radiographs of a number of different cases, the first of which I showed at the Chicago meeting of the American Society of Orthodontists in 1905, and asked the members if they did not think that this was what had taken place. (See Fig. 5 B.) Between the comparatively dense plates of the first and second molar tooth sockets, on the left, there is shown a stretching of the weaker cancellated alveolar process, while on the right the same is shown between the second bicuspid and first molar.

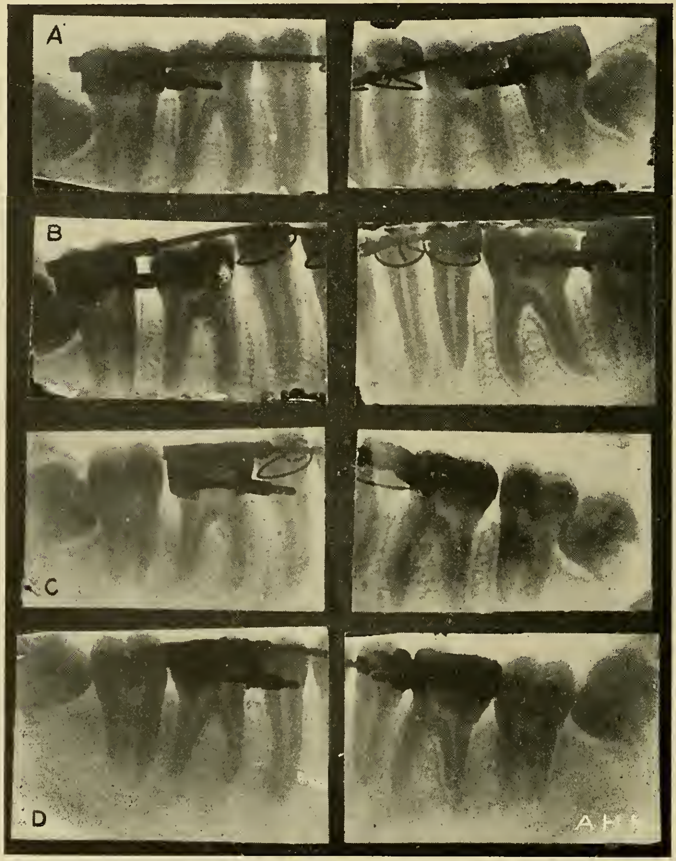

Fig. 5

Distal Movement of Molars.

The second fact which I have proved to my own satisfaction is that in the distal movement of the first and second molars, as in the treatment of class 3 cases (Angle), we do not impact the third molars,—as was claimed by Dr. M. H. Cryer in the *Dental Cosmos* of September, 1904,—or if they are impacted, increase the impaction, but that in reality when we have tipped the crown of a second molar back over that of the third, and then followed it up by tipping back the first molar, in all cases of which I have a record, the third molar has come up into place as nicely as though we had not moved the anterior molars at all.

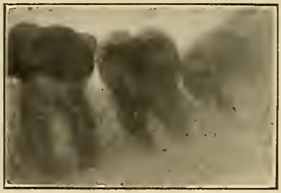

Fig. 6

Fig. 5 also illustrates this point: (A) shows the lower molars in a class 3 case before pressure was applied to move the second molars back; (B) just after the second molars were moved back and tipped over the third molars; (C) after the first molars had been driven back against the second, and (D) nearly one and one-half years later with the third molars coming up normally.

Fig. 6 is of a typical class 3 case, in which the crown of the lower second molar was tipped back into normal mesio-distal relation with the upper, to be followed by the first molar, and this radiograph taken about a year after treatment shows that the third molar has not suffered.

Abnormal Frenum Labium.

The third point which the radiograph settled was that it is not necessary in abnormal frenum cases—as has been recommended by several men, and was by Dr. Varney Barnes at our meeting in 1905—to currette the surfaces of the bone along the suture between the intermaxillary bones, in abnormal frenum cases, for the reason that the abnormal attachment of the frenum labium was due to the suture being open. Upon making radiographs of a number of frenum cases I discovered that the suture was not always open, but was sometimes closed with the inter-maxillaries in perfect juxtaposition, while radiographs of some cases in which the frenum was normally attached with the central incisors close together, revealed the fact that the suture was open; in fact, some of the largest sutures were in cases where the frenum was normal with the central incisors close together.

I reported some of these cases in *The American Orthodontist,* Vol. 1, No. 1. Since then I have secured radiographs of quite a number of abnormal frenum cases, as well as an equal number of normal—about fifty of each—and I find that the suture is open in about two-thirds of the cases regardless of the attachment of the frenum labium or of the separation or non-separation of the central incisors, and that the suture is closed with the inter-maxillaries in perfect juxtaposition in about one-third of the cases of abnormal attachment of the frenum and separation of the central incisors, and that we have the suture closed in no greater proportion of cases where the frenum is of normal attachment and the central incisors close together. From this I conclude that the abnormal attachment of the frenum labium, with the consequent separation of the central incisors, cannot be due to an open suture between the inter-maxillaries, and therefore all the surgical procedure necessary is to destroy the abnormal attachment of the frenum labium, and that curretting the surfaces of the bone along the suture between the inter-maxillaries is unnecessary. All that is left to do is to draw the centrals together, then allow them to separate slightly on the day when the operation of dissecting away the abnormal attachment of the frenum with an electric cautery is performed, after which they may be drawn together immediately and the scar tissue will help to retain them.

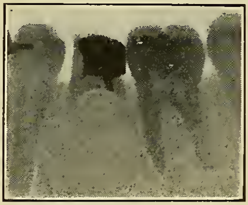

Fig. 7

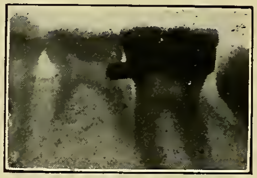

Fig. 8

Missing Bicuspids.

I have also discovered that in many cases the bicuspids are missing, the germ apparently having been suppressed. While I have not a record covering enough cases so that I can speak positively, yet my experience has been that there are just as many bicuspids that fail to develop as there are lateral incisors. The bicuspid most likely to be missing seems to be the lower second, therefore we should be very careful in advising the extraction of a temporary molar without first having it radiographed, and not recommend its removal unless we can see or feel its successor. In one of my earlier cases I allowed a second temporary molar to be extracted, and you may imagine my mortification when later on I made radiographs and found that the bicuspid was missing and that the patient would be obliged to wear an artificial substitute, which could not be as good as a well preserved temporary molar.

Fig. 7 is of a case in which, after the discovery of the absence of the second bicuspid, on account of the absorption of the roots of the temporary molar, I advised the trimming down of the crown of this tooth to the width of a second bicuspid and closed the space thus made by moving the teeth together. It is still doing duty, and four years have elapsed since treatment. It may be of interest to note that the lower second bicuspid on the opposite side of the mouth was present, but impacted, with its occlusal surface lying low down against the anterior surface of the mesial root of the first molar, so that the crown of the tooth, which was the only portion formed, was lying in a horizontal position. After the removal of the second temporary molar over this tooth, nature, assisted by an appliance, brought this tooth up into place; then it was rotated and is now doing good service. Where the roots of the temporary molar are not absorbed (Fig. 8) I do not recommend trimming the crown on the mesial and distal sides on account of preserving the contact point, but save it full size as it will probably last indefinitely.

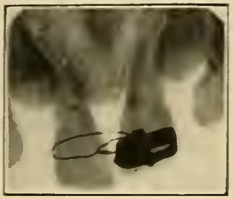
Fig. 9

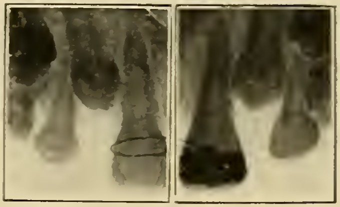
Fig. 10

Interpretation of Radiographs.

In closing let me warn the beginner that reading a radiograph for diagnosis is of the greatest importance, and that many mistakes will be made until one acquires knowledge through experience. For example, let the beginner examine the radiograph reproduced in Fig. 9. It is from a partly treated abnormal frenum case, a girl ten years of age. Let him note that the suture between the intermaxillary bones is closed; also the position of the lateral incisors;

see, too, the pulp stones in the pulp canals of the central incisors. Now let him examine the radiographs of the same case shown in Fig. 10 but taken "around the curve" over the cuspid region. From these he can see that the lateral incisors are missing; that the cuspids are pointing toward the lateral incisor position and that the pulp stones were only imperfections in the film.

Let us draw a moral from this, and in all important cases make two or three exposures from slightly different positions, especially when radiographing around the curved part of the dental arches.

Discussion of Dr. Ketcham's Paper.

Dr. Ellis. I feel honored to open the discussion of this paper by Dr. Ketcham, who has been essentially our host at this year's meeting. The paper has been as interesting and instructive as has been this good city of Denver, where we have been entertained so royally.

We are extremely fortunate in having him present this subject to us, because it is the result of many years of his own clinical experience, whereas my experience and that of many others is limited to the diagnosis of the need of a radiograph and the reference of the actual work to another, although when we have the radiograph before us we must have some little experience in its interpretation, as an expert opinion is as important as a good picture.

The essayist has made his leading points so clear, and proved them so conclusively by his slides, that it is hardly necessary for me to elaborate upon them. He has shown us that curretting between the intermaxillary bones is unnecessary, which is gratifying to me, for I have limited my own operation to lancing and cauterizing.

In regard to missing teeth, as far as my own experience goes, the bicuspids are the leaders—about equally distributed between the upper and lower.

It is gratifying to know that the third molars are not impacted in class three cases. However, I think that we move the teeth distally more seldom than we realize, in reality, moving the upper teeth mesially even in those cases where considerable distal movement of the lower molars is attempted.

I have always felt considerable timidity in handling or getting within reach of the X-rays, but with the recent perfection of the apparatus I find there is very little cause for fear. The short exposures of 15 seconds or less that are now necessary to obtain a good radiograph and the low strength of current, produces no danger of burn or other mal-effects.

In a radiograph of the skull a short exposure of five seconds will show the sinuses, as a longer exposure will not. It may be deliberately undertimed, and by using an intensifier in developing, the picture will come out satisfactory in every respect. The operator thus saves the patient from undue exposure to the influence of the rays.

In those cases where the film shows too limited an area, or where it is impossible to orient the rays upon the film properly, the plate may be used, making an exposure of the entire face. I have used this external method (plate outside the mouth) very successfully. It is obtained by placing the patient's face against the plate, pressing the nose flat until the bridge is in contact, thereby giving equal focus to the sinuses, etc., the rays, of course, coming from behind.

I have such a negative here (Fig. 1), made to locate an unerupted cuspid. It is an unusually clear negative and rather interesting in some ways, as well as for the purpose for which it was made. The exposure was very short, and made with a 2 K. W. transformer, working on 110 volts, 60 cycles, 3 phase current.

Dr. N. S. Hoff. I am not a Roentgenologist, and cannot add to the technical value of this discussion. We cannot overestimate the value of the radiograph in diagnosis, not only in orthodontia but in other branches of our work. The question was raised this morning, for example, as to the methods of diagnosing pulp conditions. We may use the X-ray apparatus with very good results in this connection, in a very satisfactory way, that I will not take your time to discuss here. The value of it, however, is very often lost because of defects in methods of manipulation, producing pictures which do not represent conditions as they are. Very many of those made for me, or those that I have seen, are so evidently distorted as to furnish pictures from which we may only guess the actual conditions. They form very good data for guess work: better than we could get in any other way, perhaps, but it sometimes requires an expert guesser to interpret the radiograph properly. So I believe the use of this means of diagnosing conditions is not to be relied upon, generally. It should not be utilized by every practitioner, for the reason that very few of us are willing to take the time to learn the technic or go to the expense of providing ourselves with proper appliances that would enable us to accomplish results that are desirable. I know enough of this work, although I do not do it myself, to realize the necessity for accuracy. I feel that it should be relegated to those who have the skill and are willing to take the time, and have the means for developing these pictures in the best possible way for us. I agree that we cannot refer these patients to the professional Roentgenologist, who is not in sympathy with our work, as he does not know just what we want to find. We should have dental operators who are proficient in this subject. Dr. E. B. Lodge, of Cleveland, is doing this better than anyone I know of. He produces as good results, so far as accuracy is concerned, as I have ever seen. We should have more men doing this work in different parts of the country, some one in every city. Another reason for referring the work to an expert is the fact of the dangers. I have had recently in my own experience, a very sad case, where an acquaintance, perhaps one of the best known Roentgenologists of the country, has recently been committed to the insane asylum in our State, and is hopelessly incurable. His ability to handle this subject technically, and in every way, was wonderful, and the fact that he has succumbed to its dangers has been to me a very great warning. We should not take up this work with portable appliances. We cannot do the work and get the best results with indifferent apparatus, and I do not quite fancy the idea of our friend Ketcham having X-ray work done in his operating room. I should have a separate room exclusively devoted to that work, and have all the apparatus there, surrounded with all the safeguards and protection possible. I certainly should not have it in my operating quarters, as the cluttering up of the office is an objection, and the possibility of harm and danger should not justify anyone in fitting up an office in that way.

I rather like the little apparatus Dr. Ketcham showed for holding the film in the mouth. That, perhaps, will answer in very many of the cases. Dr. Honeywell, who is doing this work in Ann Arbor, showed me a device he uses which I think might avoid the necessity of the clamp apparatus of Dr. Ketcham. He rolls out a piece of thin aluminum, slips it in the envelope containing the film, bends it to adapt it to the mouth, and brings it in actual contact with the teeth and other parts of which he wishes to make the picture. Either the operator or the patient may hold it in position with the finger. Some pictures made in this way were remarkably free from distortion, because he had gotten the film close up to the teeth he wished to radiograph. In the lower third molars he was able by means of this device to carry the film down on the lingual side of the jaw opposite the tooth, so that he obtained remarkably good, sharp outlines of the tooth and its relation of the jaw.

As to the use of films and plates, I have never been able to get plate pictures of the entire skull that were of very great value to me in orthodontia work. They are usually obscure because of the number of dense bony structures shown in the plate. They overlap so much that they give too much distortion. The picture of Dr. Ketcham's showing the condyloid articulation was, perhaps, as good a picture as you will ever see. It is very seldom that you can get all the relations by any such manipulation of the rays, where you try to take the whole skull, although such pictures may be very valuable for some purposes. The picture Dr. Ketcham showed, of the influence the movement of the molar teeth had in impacting the third molar, was to me quite interesting. I wish we could have more evidence of the injurious influence, or of the actual results of that kind of work. I recall Dr. Cryer's criticism, but I am in doubt whether there could be anything in it or not, particularly where the work is done for very young patients, because of the fact that the jaw bone itself (particularly the alveolar process) is sufficiently elastic so that it will yield and allow for the development which we desire, and these pictures that the doctor has shown us, illustrate the influence secured to stimulate the interstitial growth or elongation of the jaw bone, which is the important factor in the growth of the jaw bone. Therefore, I do not share Dr. Cryer's fear that we may impact third molars by orthodontic procedures, because the irritation of the roots of the molars in moving them, and the continuous stress we have from the use of the intermaxillary ligatures, will produce a sufficient amount of irritation to induce development of the bone itself, and cause an elongation which will not only affect the teeth being moved, but will cause development around the third molar and influence its eruption from its crypt. I think proper application of force is inclined rather to influence the development of the jaw, and so overcome impaction rather than if there were no such stimulus applied. The pictures of Dr. Ketcham are very convincing, although I should like to see more evidence than this one case, but I see no reason why it should not logically occur. Taking into consideration the developmental process in the child, there is no reason why the jaw bone should not develop sufficiently to give place for all the third molars. I thank the essayist very much for bringing this to our attention.

Dr. Ketcham. I wish to compliment Dr. Ellis on the beautiful radiograph of the head, which is being passed around the room. It shows deflected septum, turbinates, impacted cuspid, third molar (which may be impacted), lady's pin at the throat, etc. Evidently it was made by an operator who is making radiographs for physicians; one who is not accustomed to making dental radiographs. Such an operator usually wishes to make a head radiograph, as he is accustomed to the technic, but no head radiograph is as good for our purpose as a good dental radiograph. However, it is a splendid picture. The patient's face was placed against the plate, and we have a radiograph which shows the nasal space very beautifully. I have been wishing to take time in my cases of constricted nasal spaces, to make such radiographs before and after expansion of the dental arches.

Someone I think asked about the operation on the frenum. We still perform the operation of dissecting away the abnormal attachment of the frenum just as we used to do, but we do not go in between the intermaxillary bones and currette in order to get the two bones to close the suture.

Dr. Hoff spoke of having the X-ray coil and apparatus in a room separate from the operating room. That is proper. There is no objection, however, to having it in the operating room aside from sentimental reasons, if one has the space for it. I have a separate room for this work. It is, however, just as dangerous in one room as in another. The rays will penetrate partitions or brick walls. To protect people in adjoining rooms perfectly, you would be obliged to have the operating room fitted with metal walls. The tube shield and lead screen are principally to protect the patient and operator.

Facial Expression from the Point of View of the Artist.

By Henry Read, Denver, Col.

It may seem something of an impertinence for me, a layman, to address a convention of specialists, especially when I have to confess but a recent acquaintance with their aims and practice. However, a certain bond of sympathy between the artist and the orthodontist may be accepted as an excuse for my appearance before you to-day.

In attempting to bring such artistic experience and knowledge as I possess into practical relation with your work, I am met at the outset by the difficulty that no systematic record of observation in the direction I shall indicate appears to be available for the purpose of research, nor does modern medical science seem to have given much attention to an aspect of the subject which to me offers curious and interesting problems. I shall, therefore, ask you to regard what I have to say as merely suggestive, though worthy it may be, of further examination.

Since the practice of orthodontia affects the form of the face, and the form of the face is generally accepted as a visible expression of character, we are justified in saying that no practitioner should neglect consideration of appearance. To what extent he should be influenced by it admits of no direct answer, but a discussion of this matter cannot fail to be profitable.

In attempting to study form in its relation to beauty in the human figure, the personal equation plays so prominent a part that we shall find the investigation beset with difficulties of an unusual nature. Form is apt to be so closely associated with other constituents of beauty, and the effect upon the observer to be so greatly modified by his own idiosyncrasy, that we must be on our guard against errors arising from such a source. Nevertheless, if we compare the male with the female figure, the Caucasian with the Mongolian or the African race, Greek sculpture with contemporary life,—if we recognize the innumerable differences, both of type and of individual among all races, we shall find it hard to believe that any abstract standard of beauty can be formulated.

Must we then say that appreciation of human beauty is purely a matter of personal preference, and slightly paraphrasing a remark that all of us have heard, say, "I know nothing about beauty, but I know what I like?" Surely there is another alternative. In the first place, let us assume that a normal exists for a racial or typical group (I shall presently explain what I mean by "typical group"), and that the average or composite is the best substitute we can find for the normal; let us further assume that familiarity (both personal and inherited) with the average creates an unconscious standard in the mind to which all variations are referred, and we have a working hypothesis that fairly accounts for observed facts, and will, I think, assist us in the practical inquiry we have in hand. It does not, of course, explain the origin of form, which must be traced through the stages of evolution, and, in this connection, we face the question whether normal form, or a standard of beauty, is not the outcome of complete and perfect adaptation of the means to the end,—whether function is not the key to the situation? If this be so, the orthodontist, building his practice upon perfect occlusion of the teeth, may surely argue that normal form will follow, without extraneous assistance from facial expression, which term is here used to denote, not changes caused by more or less transient emotion, but permanent modifications of form caused by organic growth. A little reflection, however, will warn us against the danger of placing too much reliance upon a theoretical statement, which cannot be realized under practical conditions. Neither human knowledge nor human skill can lay claim to finality. It cannot be said that science has marked out the limits of function. At some future time it may possibly be shown that specific organs have functions undreamed of to-day, and discoveries may be made of interaction and inter-relation to which at present we possess no clue. Furthermore, we cannot suppose that the mental and physical powers of any practitioner are of so high an order that he can afford to dispense with such additional aid as he may be able to secure through other channels.

It seems to me these are reasons that should appeal to orthodontists for a study of facial expression from the point of view of the artist. It will supplement scientific study, and, perchance, throw many a sidelight upon otherwise obscure points. The eye sees what it looks for, and observation from another position will at least add something to the fullness of conception.

Reverting now to the expression "typical group," I wish to call your attention to another phase of the subject. Artists and sculptors, consciously or unconsciously, have been guided by a harmony of relation of the features to the head, of the head to the figure, and of the figure to a group marked by physical similarities among its members. The latter can best be illustrated by a reference to Greek sculpture. One need only recall the representations of Apollo, Hercules, Diana, Venus and Minerva, to realize that comparatively simple types have been embodied in these statues. That such variations were based on real and observed differences cannot be doubted, although classification resulting from scientific research has contributed little or nothing to exact knowledge. From those days down to the present, such terms as sanguine, lymphatic, phlegmatic, choleric, melancholic, athletic, bilious, and nervous, have been variously used to designate what have been called temperaments, and other attempts have been made to classify with reference to the locomotive, nutritive and thinking systems. It is true that manners and customs of the present day deprive us of the opportunities that were afforded in classic times to become acquainted with the human figure, but if the face is a link in the chain of bodily form, we must study it in that connection. To isolate it would expose us to the danger of forming conclusions from insufficient data. Yet it is within the experience of most of us that the face often seems to fall into some undefined grouping in the mind of the observer, and its peculiarities in the same way are recognized as departures from that standard. Provided such departures are within the limits permitted by the type, the standard of beauty has not been violated. From this it follows that facial expression cannot safely guide the orthodontist, if it be referred to an abstract and unvarying standard.

It sometimes happens that the restoration of a face to its normal form does not meet with unreserved acceptance by intimate friends and relations. If it is really restoration, so far as it can be attained by the employment of knowledge and skill, this is not a serious trouble. We are so constituted that familiarity with what is abnormal soon becomes acquiescence, and change is resented.

I will here quote passages from a letter of Lafcadio Hearn, written in Japan, which also serve to remind us of racial differences, although they deal with questions of color and not of form. He says:

"But to appreciate the beauty of colored skins, it is not simply enough to travel,—one must become familiar with the sight of them through months and years (so strong our prejudices are!)" And again, "Either Stanley, or Livingstone, perhaps, told the world that after long living in Africa, the sight of white faces produced something like fear. (And the evil spirits of Africa are white.) Well, even after a few months alone with black faces, I have felt that feeling of uncomfortableness at the sight of white faces. Something ghostly, terrible, seemed to have come into those faces that I had never imagined before. I felt for a moment the *black man's terror of the white*,—at least I think I partly realized what it is."

Another matter presents itself. Because the practice of orthodontia is most effective during the period of childhood and youth, the foregoing considerations are important, in so far as they may influence the practitioner by the suggestion of an ideal not created by a knowledge of organic function. During the formative period of life, facial proportion and expression give little indication of adult development, and any study that will aid in forecasting it must of necessity possess a real value.

In order to convey a clear impression of the views embodied in this brief address, I will recapitulate the main statements it contains:

(a) There is no absolute standard of human beauty.
(b) A relative standard can be found in the average or composite.
(c) Such average or composite must be confined to a group.
(d) Race, sex, and so-called temperament, indicate the meaning of a group.
(e) The character of the face bears a distinct relation to the character of the body.
(f) Function may be the ultimate test of beauty, but there are practical obstacles to any effective application of the test.

In closing, I wish merely to add that I am conscious of a superficial treatment of the subject, but hope nevertheless that it will serve the purpose intended, of arousing your interest and attention.

Tooth Powders—Their Ingredients and Effect on Bacteria.

By Daniel S. Neuman, M.D., Denver, Col.
Attending Surgeon in Otology, Rhinology, and Laryngology, St. Anthony's Hospital; Attending Laryngologist to the Jewish Consumptive Sanitarium.

Plato in his description of Atlantis makes possibly the earliest written record of the use of dentifrice.

In his famous description of the lost continent, he mentions several times (in describing the ladies of that period), some who possessed what were supposed to be magical and secret formulas which, if used every day, would render the teeth white and beautiful.

The knowledge of the Egyptian embalmer, how to clean and render the teeth white, is a matter of history.

In the British Museum, on a stone tablet taken from the ruins of Babylon, can be plainly seen and interpreted the evidence that some process was used in rendering the teeth white.

One who has read the "Arabian Nights" can easily conceive the importance which was attached by the Orientals to the use of cosmetics for the purpose of beautifying the face and teeth.

The Turkish harems were possibly the first to establish, so to speak, a specialist, whose sole duty was cleaning the teeth and seeking to discover new remedies for whitening and beautifying them. The prehistoric and primitive man was not in need of any dentifrice, as his mode of living, mainly on uncooked animal food, supplied a sufficient amount of oxygen without any assistance.

The poets of all nations and ages, in speaking of beautiful women, invariably mentioned their white teeth as one of their chief charms.

I could quote for hours from the history of the past, both civilized and uncivilized, to prove still more clearly that the care of the teeth and use of dentifrices was merely for the purpose of beautifying, nor can I find a single instance where in past time the people realized that cleanliness of the teeth was essential to health.

To-day we know that dentifrice has a more important function than that of merely beautifying.

It is only of late years that the importance of keeping the mouth free from remnants of food and masses of tartar commences to be recognized.

The putrefaction of the particles of food which accumulate between the teeth very often becomes a center of diseases and infection; deposits precipitated by the fluids of the mouth sometimes accumulate in large quantities and incrust the teeth.

We know that the formation of pus is very common, and due to the suppuration of the gums. The Fra, in his famous sentence, "The man with the healthy mouth is never sick; the sick man never has a healthy mouth," covers fully the true situation from the result of decay, fermentation and bacteria in the mouth.

During the last few years it has been proven conclusively that decay of the teeth is mostly due to fermentation bacteria and fungi: to stop fermentation it is necessary to use a remedy entirely different from that which will render the life of the bacteria short.

The good tooth powder is one which contains in combination ingredients which will perform this double function.

It is my intention to-day to review for you the tooth powders of the past, with their ingredients, and compare them with those of the present day, for which we are indebted to the knowledge of chemistry, bacteriology and the modern dentistry.

Ingredients Commonly Used In Tooth Powders.

The customary ingredients are chalk, pumice stone, orris root, soap, myrrh and cuttle fish bone.

We will first consider the chalk; it is possibly the only rational remedy in the older tooth powders prescribed; the others of them form an insoluble mass which often enters between the free margins of the gums and forms a foreign body which will eventually produce inflammation of the surrounding tissues.

Of late we notice a good deal of criticism of the tooth powders containing salol, as at a certain temperature and coming in contact with the acids and ferments of the mouth, it often liberates free carbolic acid.

The pumice stone is only safe in the hands of a dentist, and not for repeated daily use.

The oxygen tooth powders, which have apparently come to stay, do not all possess merit, as some of them are incompatible, and some contain oxide of lime.

The good oxygen combination, to my mind, is one which contains the following ingredients: borated sodium peroxide, magnesium peroxide, aluminum hydroxide and calcium carbonate.

With your permission I will endeavor to analyze each of these substances separately.

Borated sodium peroxide, as we all know, is practically powdered peroxide of hydrogen, and being alkaline in reaction, contains a small amount of peri-borax, which also acts as an antiseptic.

It is a sodium salt of perboric acid; it contains nine per cent. of oxygen. It occurs as a white granular salt soluble in water. It is decomposed by water into hydrogen peroxide, producing an alkaline solution; heated to sixty degrees C, it develops oxygen and ozone. It is antiseptic, deodorant and bactericidal.

Magnesium peroxide (which secretes oxygen more slowly than the borated sodium peroxide) is a strong antacid; it contains sixteen per cent. of oxygen; it has activity to decompose ferments and animal tissue; it has a bleaching and disinfecting effect and is generally used in place of the hydrogen peroxide.

Aluminum hydroxide has all the beneficial effects of chloride of potassium, being a secondary oxydizer without any of the corrosive or toxic action of the potassium. It is a colorless, white powder, odorless and having a cooling, saline taste and is soluble in water. Like the potassium permanganate, it has been employed in various diseases of the nose and throat in ulceration, syphilitic mucous patches and herpes of buccal cavity.

Calcium carbonate is an antacid and forms a heavy body for the mixture.

The many species of microbes and most of vegetable organisms are the cause of a large class of infection and contagious diseases.

The process of fermentation is in itself the growth and multiplication of these micro-organisms.

The effect of oxygen on bacteria can be easily demonstrated in a bacteriological laboratory, and, as we have to deal in the mouth mostly with non-oxygen living bacteria, this makes it more desirable.

The bleaching power of oxygen has been known for ages, the slight astringent effect of aluminum hydrate is very beneficial to the abrasions of the soft tissues which surround the teeth.

The combination above mentioned makes a very desirable tooth powder for orthodontists on account of the scouring and polishing effects on the metals.

The Movement of Teeth Bodily.

By Dr. Ray D. Robinson, Los Angeles, Cal.

The writer claims no originality for principles or appliances, but describes an application of principles long recognized and accepted to better produce certain desired movements of the teeth.

By the use of the expansion arch of Angle, and others of similar principle, the molars and bicuspids are tipped buccally when an expansion of the dental arch is accomplished. This results in a faulty occlusion of the grinding surfaces of these teeth, which is undesirable. This can be avoided and each tooth moved bodily, either buccally or lingually, at will by making the application of force in the following manner:

In a case requiring expansion of the molars and bicuspids, soldered bands of iridio-platinum are prepared for each tooth to be moved. To the buccal surfaces of these are soldered tubes, parallel to the long axes of the teeth, to extend beyond and buccally of the gum margins. The bands are cemented to place. Next an iridio-platinum arch is prepared to which are soldered spurs in the proper places to enter the tubes when the arch is put into position. The tubes should be two sizes larger than the spurs. This is quite necessary as there is danger of breaking the spurs from the arch, when forcing them to place, if the fit is accurate. With an appliance prepared in this manner the teeth can be moved buccally, bodily. The apex of the roots can be moved as far as the crowns. (Fig. 1.)

If it is desirable to move the apices of the roots farther than the crowns, this can be accomplished by soldering the spurs to the expansion arch at such an angle that the free end of the spur will stand farther away from the tooth than the soldered end when the arch is placed in the mouth, and allowed to be at rest. (Fig. 2.) When the spurs are forced into the tubes the arch must be forcibly twisted and the torsion exerted by the arch will then move the apices farther than the crown.

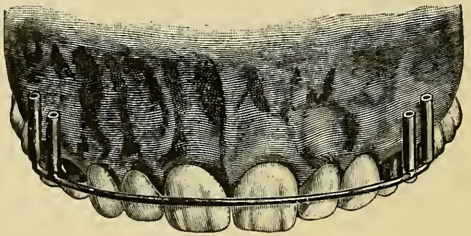

FIG. 1.

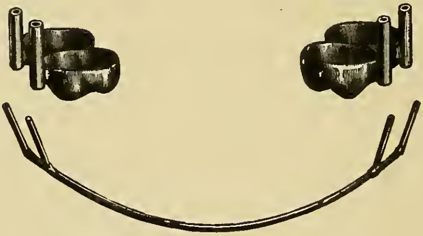

FIG. 2.

In other words the relative extent of movement of the apex and the crown will depend on the degree of torsion exerted as compared with the amount of expanding force, and the relation between these two forces is under the control of the operator at all times.

It is, of course, to be understood that if any great movement of the apex is desired, beyond the movement of the crown, that the spurs are to be removed and resoldered at a greater angle every few weeks.

Another class of cases in which a similar appliance is indicated is that in which space must be secured for a tooth, as is well illustrated by the first bicuspid being nearly or quite in contact with the lateral and the cuspid in buccal and infra occlusion with little or no space for it to assume its normal position. By the use of the Angle arch space can be secured, but in doing so the lateral is tipped mesially and labially, and the apex of the root is left in the position which should be occupied by the cuspid. But if the lateral be banded as described above, and the usual anchor band placed on the first bicuspid, and a threaded iridio-platinum arch is prepared and to it soldered a spur to engage in the tube on the lateral, the desired space can be secured without the least tipping of the lateral, and the cuspid is much more readily moved to place because the lateral root is not in its way.

It is recognized that there are other methods of moving molars and bicuspids buccally, bodily, as by the use of the square tubes on the anchor bands, suggested by Dr. Kemple, and by the split tube as devised by Dr. R. Ottolengui, but by the use of either of these only one tooth on each side is moved bodily and the others are tipped.

I have experimented with this appliance for three years and I believe the results accomplished warrant my description of it and its adoption, for trial at least, by other orthodontists.

Its advantages over other forms of appliances in use are:

First. Much better occlusal results are obtained by it.

Second. The enlargement of the nasal passages is tremendously greater than by any method that tips the molars and bicuspids in expansion.

These two advantages overshadow any disadvantage it might develop.

Third. The patient can remain away from the operator much longer periods of time.

Fourth. It compels the use of the iridio-platinum arch, which is, in my mind, far superior to the German silver.

Fifth. The period of retention is much shortened. The appliance itself being the best possible retaining device.

Its one disadvantage is that it requires more skill, time and work to make and place the appliance properly.

Items of Interest

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